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Volume I

IP and Antitrust

An Analysis of Antitrust Principles Applied to Intellectual Property Law

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the listing of information in the Orange Book and by limiting patentees to a single 30-month stay for any given drug, regardless of the number of patents listed as covering that drug.[31] The result is that while antitrust challenges to past evergreening efforts will continue, there are unlikely to be new cases brought on the basis of continuing conduct.

§12.5 Product Changes in the Context of FDA Approval

Pharmaceutical patent owners have engaged in a second form of evergreening, one that might be described as "product-hopping." Product-hopping pharmaceutical companies faced with the possibility of generic competition once a patent expires or is held invalid sometimes make trivial alterations to their approved drugs, get FDA approval for those trivial alterations, and then replace the old product with the new product. For example, a patentee might switch from selling a drug in capsule form to selling the same formulation of the same drug in tablet form. While the change won't matter much to consumers, it can be sufficient to require a generic company to start the ANDA filing process over from scratch, delaying the date of generic entry and triggering an entirely new round of patent litigation. Because the patented pharmaceutical is now being sold only in the new tablet formulation, the generic company will be unable to rely on generic substitution to sell its ANDA-approved capsules. A number of antitrust challenges to product-hopping are pending as of this writing.[1]

A pharmaceutical patent owner has no legal duty either to help its generic competitors or to continue selling a particular product. Patent owners may argue with some justification, therefore, that they cannot be held liable for stopping the sale of a product. At the same time, product-hopping seems clearly to be an effort to game the rather intricate FDA rules to anticompetitive effect.[2] The patentee is making a product change with no technological benefit solely in order to delay competition. Under the analysis we offer in section 12.3e3, such a change could qualify as a predatory product change if it lacks substantial medical benefits.

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31. 21 U.S.C. §355(j)(5)(b).

§12.5 1. In addition to the *Abbott v. Teva* case discussed below, see *FTC v. Warner Chilcott Holdings Co.*, 2006 WL 3302862 (D.D.C. Oct. 23, 2006). That case, which is ongoing, involves a number of allegations by the FTC, including product hopping.

2. See *Abbott Labs v. Teva Pharm.*, 432 F. Supp. 2d 408 (D. Del. 2006) (citing Treatise).

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In *Abbott Labs v. Teva Pharmaceuticals*,[3] the court faced such a claim as a matter of first impression. Teva, a generic pharmaceutical manufacturer, alleged that Abbott engaged in a pattern of excluding generic substitutes for TriCor by making a series of changes to its product timed to prevent Teva from introducing a generic substitute. Teva alleged that the changes were of little or no medical value (one change was from capsules to tablets, and another reduced the active amount of the drug slightly), and that the changes were made just as Teva was poised to introduce a generic substitute. Further, Teva alleged that Abbott not only changed its product but bought up and destroyed its old products and listed them as obsolete in a national drug database. As a result, Teva argued, while it was able to enter the market and sell its drugs, it could not take advantage of state generic substitution laws, because Abbott's changes prevented Teva's drug from being equivalent and required it to start over in seeking FDA approval for the modified drug.

Abbott moved to dismiss Teva's antitrust claims, and the district court denied the motion. The court noted that it "faces a difficult task when trying to distinguish harm that results from anticompetitive conduct from harm that results from innovative competition."[4] Nonetheless, the court concluded that rule of reason treatment was appropriate in this instance without any special deference to the defendant's product changes, since the allegations were that those product changes wouldn't face market competition because of regulatory barriers:

> The nature of the pharmaceutical drug market, as described in Plaintiffs' allegations, persuades me that the rule of reason approach should be applied here as well. The per se standard proposed by Defendants presupposes an open market where the merits of any new product can be tested by unfettered consumer choice. But here, according to Plaintiffs, consumers were not presented with a choice between fenofibrate formulations. Instead, Defendants allegedly prevented such a choice by removing the old formulations from the market while introducing new formulations. Hence, an inquiry into the effect of Defendants' formulation changes, following the rule of reason approach, is justified. . . .

3. 432 F. Supp. 2d 408 (D. Del. 2006). To the extent it is relevant, M.L. represents Impax Labs, antitrust plaintiff in this case.
4. *Id.* at 421.

Therefore, in this case, an antitrust inquiry into the benefits provided by Defendants' product changes is appropriate. Contrary to Defendants' assertion, Plaintiffs are not required to prove that the new formulations were absolutely no better than the prior version or that the only purpose of the innovation was to eliminate the complementary product of a rival. Rather, as in *Microsoft*, if Plaintiffs show anticompetitive harm from the formulation changes, that harm will be weighed against any benefits presented by Defendants.[5]

Because Teva had alleged that the product changes were not significant improvements and were not cost-justified, its allegations survived the motion to dismiss.

Abbott also argued that because Teva was free to sell the old formulation of TriCor, Abbott's product changes could not have had an anticompetitive effect. The court rejected that claim as well:

To show that conduct has an anticompetitive effect, "it is not necessary that all competition be removed from the market. The test is not total foreclosure, but whether the challenged practices bar a substantial number of rivals or severely restrict the market's ambit." *United States v. Dentsply Int'l, Inc.*, 399 F.3d 181, 191 (3d Cir. 2005). Competitors need not be barred "from all means of distribution," if they are barred "from the cost-efficient ones." *Microsoft*, 253 F.3d at 64. Here, while Teva and Impax may be able to market their own branded versions of the old TriCor formulations, they cannot provide generic substitutes for the current TriCor formulation, which is alleged to be their cost-efficient means of competing in the pharmaceutical drug market. That opportunity has allegedly been prevented entirely by Defendants' allegedly manipulative and unjustifiable formulation changes. Such a restriction on competition, if proven, is sufficient to support an antitrust claim in this case.[6]

A variant of product-hopping that has yet to be litigated involves the bundling of two drugs, one with patent protection and one without, into a single cocktail. Changing from a single drug to a multi-drug cocktail presents issues similar to changing the formulation of a single drug. A court should not hesitate to find such conduct anticompetitive if the cocktail lacks significant medical benefits over the single drugs alone, if they are sold only in cocktail form and if timed to coincide with the expiration or invalidation of a patent. On the other hand, combining drugs can

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5. *Id.* at 422 (citing Treatise) (citation omitted).
6. *Id.* at 423.

§12.5   Innovation and Product Changes

have significant medical effects, and as discussed above, courts should show some deference when faced with evidence of significant medical benefit.[7]

Several cases have been filed regarding Abbott's marketing of the patented AIDS drug Norvir alone and in conjunction with other protease inhibitors whose patents have expired. Those cases present an issue somewhat different from the one just discussed, because Abbott has not withdrawn the drug from the market or used the FDA process to prevent generic competition for that drug standing alone. Rather, the plaintiffs alleged that Abbott raised the price of its patented drug standing alone in order to make its patent-generic drug cocktail more attractive by comparison, and therefore to dominate the market for that combination despite the ability of generic companies to sell the complementary protease inhibitor. In *Schor v. Abbott Labs*,[8] the Seventh Circuit dismissed the complaint for failure to state a claim, refusing to accept monopoly leveraging as a valid theory of antitrust harm and finding that the plaintiff had not stated a claim of a tying arrangement. Indeed, the court found the allegations implausible as a matter of economic theory: "Abbott's profits are highest when the price of other protease inhibitors is lowest, and Abbott therefore has a powerful incentive to encourage competition among other producers rather than monopolize the market for all protease inhibitors."[9] By contrast, a district court in California has found that the same claims (filed there by a class of purchasers) were sufficient to survive summary judgment.[10] It is notable that the Ninth Circuit, unlike the Seventh, permits claims for monopoly leveraging.[11]

The product-hopping problem could be solved if the FDA Act permitted generic substitution across formulations. In the absence of such a statutory change, antitrust cases will continue to arise.

7. See *supra* §12.3.
8. 457 F.3d 608 (7th Cir. 2006).
9. *Id.* at 614.
10. *In re Abbott Labs Norvir Anti-Trust Litig.*, 442 F. Supp. 2d 800 (N.D. Cal. 2006).
11. See *Image Tech. Servs. v. Eastman Kodak Co.*, 125 F.3d 1195 (9th Cir. 1997).

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VOLUME 2A

PART TWO - Market Structure Issues

CHAPTER 5 - Market Power and Market Definition

5A - Defining Market Power

Antitrust Law Para. 507

LENGTH: 1605 words

Paragraph 507 - Economic Relationship Among Market Power, Elasticity of Demand, and Elasticity of Supply*

TEXT:

This Paragraph explores in more technical form what the previous Paragraph stated more generally: a firm's market power depends on the elasticities of demand and supply it faces. Because market power varies with the rate at which buyers substitute other products for that of the defendant, n1 too little or too much power is often inferred when markets are traditionally defined by absolutely including or excluding each substitute.

507a. Elasticities defined. An *elasticity* measures the percentage change in one variable that results from a given percent change in a second variable, holding everything else constant. The changes are expressed as percentages, lest the results vary meaninglessly with the units of measurement. A one-unit change in the quantity of sugar would be large if sugar is measured in tons but small if measured in teaspoons; a 1 *percent* change in the quantity of sugar is the same regardless of the unit of measurement.

The *price elasticity of demand* measures the percentage change of the quantity demanded of some good in response to a given price change. This relationship is best conceived as a fraction, in which the percentage change in quantity is the numerator and the percentage change in price is the denominator. For example, the price elasticity of demand is 0.5 if a 5 percent demand decrease results from a 10 percent price increase. When the changing price is the defendant's, economists speak of the *own-price elasticity of demand* or simply the elasticity of demand; when the changing price is that of another supplier, we speak of the *cross-price elasticity of demand* or simply the cross-elasticity of demand. n2 For example, when the defendant charges more for fuel oil, a smaller quantity is sold; the ratio of the demand fall to the price rise--each in percentage terms--is the own-price elasticity of demand for oil. When the price of coal rises, demand for substitutable oil will rise; the ratio of the coal price increase to the oil demand increase is the cross elasticity of demand as between coal and oil.

Similarly, the *price elasticity of supply* is the ratio of the percentage change in supply to the percentage change in price of a particular product. When the price of fuel oil rises firms will be inclined to produce more in order to capture additional profits. The more that production increases in response to a given price increase, the higher is the price elasticity of supply. Because the percent change in quantity (or price) is simply its absolute change divided by its absolute level, n3 the elasticity of supply is

$$\epsilon^s = (\Delta Q^s_i / Q^s_i)/(\Delta P_i / P_i)$$

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where $Q{<}s{>}{<}i{>}$ denotes the quantity of good i supplied, $P{<}i{>}$ denotes the price of good i, and [DELTA], the Greek capital letter delta, means "the change in."

The elasticity of demand is

$$[epsilon]{<}d{>}{<}ii{>} = - (([DELTA] Q{<}d{>}{<}i{>}/Q{<}d{>}{<}i{>})/([DELTA] P{<}i{>}/P{<}i{>}))$$

where $Q{<}d{>}{<}i{>}$ denotes the quantity demanded of good i, and the subscript ii on the elasticity reminds us that this is the *own-price* elasticity of demand for good i with respect the price of good i. Because these two variables move in opposite directions--quantity demanded falls as price rises--the elasticity is a negative number, but the negative sign is often dropped for simplicity.

Similarly, the cross-price elasticity of demand for product i with respect to the price of product j is

$$[epsilon]{<}d{>}{<}ij{>} = - (([DELTA] Q{<}d{>}{<}i{>}/Q{<}d{>}{<}i{>})/([DELTA] P{<}j{>}/P{<}j{>})).$$

When the cross-price elasticity of demand for good i with respect to the price of good j is positive, an increase in $P{<}j{>}$ causes the demand for good i to rise; in that case, the goods are *substitutes* (as fuel oil and coal). Conversely, if the cross-price elasticity is negative, the goods are *complements* (as cigars and matches). While $[epsilon]{<}d{>}{<}ij{>}$ and $[epsilon]{<}d{>}{<}ji{>}$ have the same sign, they are not generally equal.

A product i's own-price elasticity of demand is determined entirely by its various cross-price elasticities of demand: The own-price elasticity of demand equals the sum of the cross-price elasticities of demand for all other goods with respect to a change in the price of good i. In effect, the own-price elasticity is equal to the sum of all substitutions to all other products that result from a given price increase. Each cross-price elasticity is weighted by the expenditure on that good relative to expenditure on product i. n4 This means, consistently with intuition, that the demand for a product is more highly responsive to its price (its own-price elasticity will be larger) as substitutes are closer and more numerous. For example, if cellophane and aluminum foil have a very high cross-elasticity of demand at a given price, then cellophane is likely to have a very high own-price elasticity at that price. But large individual positive cross-price elasticities of demand are neither necessary nor sufficient for the own-price elasticity of demand to be large. Demand could still be highly responsive to price (large own-price elasticity) even if no single good is a strong substitute so long as there are many goods that are somewhat substitutable (many small, positive cross-price elasticities) or expenditure on weak substitutes is relatively large. Conversely, one or more large positive cross-price elasticities will not imply a large own-price elasticity if expenditure on the substitutes is relatively small. For example, even if a 1 percent increase in the price of pepperoni leads to a 50 percent increase in the consumption of anchovies, the effect of the price increase on the consumption of pepperoni would be small if anchovy consumption were small to begin with. n5 When we turn away from substitutes, important *complements* for a product (many or large negative cross-price elasticities) reduce the responsiveness of quantity demanded to price when everything else remains the same. n6

Demand elasticities depend not only on physical substitutability between two (or more) goods but also on their prices. At different prices, elasticities differ. For example, cognac and lighter fluid can each start a fire in the barbecue pit equally well, but the demand for lighter fluid is likely to be relatively inelastic when its price is substantially below the price of cognac (or other substitutes). It would become more elastic as the lighter fluid price rises toward the cognac level and induces more consumers to shift away from lighter fluid. n7

Products can be effective substitutes without "physical" inter-changeability. For example, chickens lay more eggs when given more food and light. To maximize egg production while minimizing cost, the farmer must choose the optimal combination of food and light. Up to a point, therefore, chicken feed substitutes for the electricity used to light the barn. Similarly, airline seats substitute for automobiles and restaurants for grocery stores. Still, such goods are not competitive unless the degree of substitutability is very high for many customers. Even then, they would not be in the same market unless the availability of one effectively limited the price of the other to the competitive level or something slightly above.

507b. Relationship between elasticities and Lerner Index; residual demand. n8 A firm's ability to price profitably above marginal cost (the Lerner Index) depends on the volume lost by raising price (demand elasticity). The more elastic the demand a firm faces, the less market power it has. n9 This particular demand--that is, the demand facing the individual firm rather than the demand facing the entire market--is called *residual demand*, which is defined as the entire *market demand* minus the *production* of all other producers.

When the elasticity of demand facing the individual firm is less than one ([epsilon] < 1), residual demand is said to be "inelastic." In this case, marginal revenue is negative; an additional sale requires a price reduction so large that the

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reduction in revenue from previous sales more than outweighs the revenue from selling the additional unit. n10 In that case, a *reduction* in sales leads to higher revenues; it also clearly leads to lower costs and therefore to higher profits. A profit-maximizing firm will continue to raise its price until its residual demand curve becomes elastic ([epsilon] > 1).

One can calculate the residual demand elasticity at the profit-maximizing level of output that would be necessary to produce any specified value of the Lerner Index. The following formula then gives the ratio of price to marginal cost as a function of the elasticity:

$$P/MC\langle i\rangle = [epsilon]\langle d\rangle\langle i\rangle/([epsilon]\langle d\rangle\langle i\rangle - 1).$$

From this it is possible to calculate the residual demand elasticity (again, at the profit-maximizing output) necessary to get a specified deviation of price from marginal cost. For example, a profit-maximizing price 5 percent above marginal cost indicates a residual demand elasticity of approximately 20. n11

FOOTNOTES:

n1 This convenient term designates the firm whose power is being examined.

n2 Since the elasticities being measured are those of the firm, it makes no difference whether the product offered by others is precisely identical or a distinguishable substitute. However, the more closely the product of others is regarded by consumers as interchangeable, the higher is the cross-elasticity of demand.

n3 Of course, the absolute level of the denominator before the price change is not the same as the absolute level afterward. If the two levels are close, the result is mostly independent of which is used as the denominator. When they differ significantly, the usual denominator is the average of the initial and final levels, yielding a so-called arc elasticity.

n4 Formally, defining own-price elasticities to be positive:

[See formula in printed version.]

n5 For example, assume that current consumption of pepperoni is 50,000 tons and consumption of anchovies is 50 tons. In response to a 1 percent price increase in pepperoni, enough people substitute to anchovies to increase their consumption by 50 percent to 75 tons. This 25-ton increase in anchovy consumption likely has little consequence for the size of pepperoni consumption.

n6 For example, pilots (and other inputs) are complements to airplanes. The demand for airplanes tends to fall when pilots' wages rise, making the cross-elasticity of demand between pilots and airplanes negative. Suppose that operating an airplane costs $ 10,000 per hour, including the pilot's wage of $ 100. Increasing the pilot's wage by 50 percent would tend to reduce the demand for airplanes (or an airline's other inputs) but, in this instance, only trivially.

n7 See P539a on the so-called Cellophane fallacy.

n8 The concept of residual demand and its measurement are highly important for measuring market power under the "alternative" mechanisms described in P525.

n9 Recall that a profit-maximizing firm equates marginal cost and marginal revenue. Further, marginal revenue is related to price by $MR = P(1 - 1/[epsilon]\langle d\rangle)$; see P503a. It follows that

$$(P\langle i\rangle - MC\langle i\rangle)/P\langle i\rangle = 1/[epsilon]\langle d\rangle\langle i\rangle$$

where the subscript i on the elasticity variable serves as a reminder that what is relevant to measuring a firm's market power is the responsiveness of the *firm's* sales to an increase in its price--that is, we speak of the elasticity facing the firm, not the elasticity facing the market.

n10 If the elasticity of residual demand is less than one, the Lerner Index gives a nonsensical result; it implies that the difference between price and marginal cost is greater than the price itself, which is impossible if marginal cost is positive. This does not imply a failure of the relationship; instead this reflects the fact that it is not profit-maximizing for a monopolist to sell in an inelastic part (that is, where [epsilon] < 1) of its demand curve.

n11 Calculating the value of the elasticity (measured where price equals marginal cost) that is necessary to obtain a specified profit-maximizing markup requires two further pieces of information--*first*, how the elasticity varies along the residual demand curve and, *second*, how marginal cost varies with output.

[SEE ILLUSTRATION IN ORIGINAL]

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This figure demonstrates the first point. It shows two alternative residual demand curves and their corresponding marginal revenue curves that both give rise to the same markup and therefore have the same elasticity at the profit-maximizing quantity $Q<m>$. For the purpose of comparison, marginal cost is assumed to be constant. The curved demand curve has a constant elasticity, so the elasticity has the same value where price equals marginal cost ($Q<c>$) that it has at $Q<m>$. By contrast, along the straight-line demand curve the elasticity falls as quantity rises, so the elasticity has a lower value where price equals marginal cost ($Q'<c>$) than it has at $Q<m>$. In order to produce a Lerner Index of 5 percent (that is, showing a price 5 percent above marginal cost) the constant elasticity demand curve would have to have an elasticity of 20 at $Q<c>$, while the linear demand curve would have to have an elasticity of 10 at $Q'<c>$.

[SEE ILLUSTRATION IN ORIGINAL]

This figure demonstrates the second point. It shows a linear demand curve and its corresponding marginal revenue curve and two alternative marginal cost curves that give rise to the same markup. Clearly, price equals marginal cost at a smaller quantity ($Q<c>$) on the upward sloping marginal cost curve than on the flat marginal cost curve ($Q''<c>$); since the elasticity of residual demand falls as quantity rises, it must be higher at $Q<c>$ than at $Q''<c>$.

These examples take as their starting point a given monopoly profit-maximizing equilibrium, with a specified deviation of price from marginal cost. As a result, the quantities and prices differ at the competitive points, where price equals marginal cost. Similar comparisons can be made that take as their starting point a given competitive equilibrium. In that event, the elasticity of residual demand at that equilibrium is not sufficient to determine the profit-maximizing deviation of price from marginal cost. Again, it is necessary to know about the shapes of the residual demand and marginal cost curves. This last fact is important because it means that we cannot simply infer from the elasticity of demand in a competitive equilibrium how large the markup would be if the market came to be dominated by a single firm or cartel.

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VOLUME 2A

PART TWO - Market Structure Issues

CHAPTER 5 - Market Power and Market Definition

5C - Market Definition--General Considerations

Antitrust Law Para. 536

LENGTH: 950 words

Paragraph 536 - Hypothetical Price Increase Methodology to Define Market

TEXT:

A given product in a given region is a market of its own if a hypothetical firm controlling all its output ("hypothetical monopolist") could maximize profits at prices significantly above the competitive level. What prevents the hypothetical monopolist of product A from doing so is the ability of customers to shift (1) to substitute product B, (2) to more geographically remote producers of product A, or (3) to firms that shift some of their resources to producing product A. If such shifts would render supracompetitive pricing by the hypothetical monopolist unprofitable, then the B firms are part of the market in which to measure the shares of the A firms. The rationale is that competition from the B firms would either prevent the hypothesized price increase from occurring or restore prices to pre-increase levels.

These indisputable propositions suggest the following methodology for defining the market, which has also been adopted by the government's 1992 Guidelines for horizontal mergers. n1 Begin by characterizing product A as a "provisional market." Then ask whether a "significant" price increase by a hypothetical A monopolist--assuming everything else remains constant--would maximize its profits. If so, A is the market. If not, the reason is presumably too many shifts to or by the B firms. Therefore, we then ask whether a hypothetical monopolist controlling all the output of both A and B could profit from a significant price increase. If so, the market includes both A and B. If not, the provisional market is broadened further to include the next best substitute until we identify that group of firms that could profit from a significant price increase. n2 The market is the smallest grouping that satisfies this test.

Although this methodology often speaks of a "profitable" price increase, it insists that the hypothetical monopolist *maximize profits* by increasing price *at least* significantly. To illustrate the first highlighted phrase, suppose the hypothetical monopolist could increase profit by raising prices a significant 20 percent but could make even more profit by raising prices an insignificant 1 percent. Because such a firm could not rationally make the larger move, it lacks the realistic power to raise prices significantly. To illustrate the second highlighted phrase, suppose that raising an A price by a significant 10 percent would be unprofitable because too many customers would shift to product B but that a 20 percent increase would be highly profitable because the incremental revenue from non-shifting customers would more than offset that lost from the shifters. Obviously, the A market should not be broadened to include product B. Hence, the unprofitability of a significant price increase does not end the inquiry when an even greater price increase might maximize profits. As the hypothesized price increase departs further from current prices, however, estimates about customer responses become increasingly speculative. n3

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To apply the price-increasing methodology, we must (1) resolve what goes into the initial provisional market *A*, (2) define the magnitude of a "significant" price increase, (3) assess the likely reactions of *A* customers and *B* firms, and (4) avoid the overly broad market definition that would result when current *A* prices are already supracompetitive. We consider the second and third issues in PP537-538 and explain and analyze the fourth in P539. Here we pause briefly on the provisional market. On each issue, we compare and contrast the government's 1992 guidelines for horizontal mergers.

The most obvious provisional market is a given product in a given region. n4 Of course, if transport costs are trivial, then the relevant region can be the whole country. Similarly, established shipping patterns and close price correlations often indicate that products or regions are in the same market. n5 Moreover, two products are provisionally part of the same market when they employ similar technologies and similar costs and customers use them interchangeably. n6 Also in the same market is the relevant output of firms that use similar technology and commonly bid against each other for the same sales. n7

In cases of doubt, output should generally be excluded from the provisional market, for incorrect exclusions will ultimately be brought into the market via the price increase methodology.

That the government guidelines adopt this approach is important. Although they do not bind the courts, n8 the guidelines influence many judges, for they state the policy of the antimerger statute, a mode of analysis indicating the questions to be considered, the sequence of the inquiry, and possible solutions. Furthermore, the economic and business expertness of the Antitrust Division and the Federal Trade Commission itself commands some deference. n9 In practice, moreover, the government's position often determines whether a merger will be consummated in the first place. Because most mergers have few immediate effects on price, private challenges are relatively few. Because litigating with the government is expensive, firms contemplating mergers often abandon those that the government is likely to challenge.

FOOTNOTES:

n1 The complete text of Guidelines appears in Appendix A of the Supplement. See 1992 Horizontal Merger Guidelines § § 1.1 (product market), 1.2 (geographic market).

n2 1992 Horizontal Merger Guidelines § 1.11 n.9 defines the "next best substitute" as "the alternative which, if available in unlimited quantities at constant prices, would account for the greatest value of diversion of demand" in response to the significant price increase.

n3 Measurements of demand elasticities are most reliable in the range of current prices or historical prices for which data are available. Measuring demand elasticity at a purely hypothetical price 20 percent above current levels could be highly speculative.

n4 The merger guidelines start with the product of the merging firms. 1992 Horizontal Merger Guidelines § § 1.0-1.1.

n5 See PP550 and 552. Moreover, the producers in region *B* are presumptively part of the *A* market when goods move from *B* to *A*, but *A* firms are not part of the *B* market if no goods move in that direction.

n6 See P561.

n7 See P562.

n8 See *United States v. Atlantic Richfield Co., 297 F. Supp. 1061, 1073 (S.D.N.Y. 1966),* aff'd mem. sub nom. *Bartlett v. United States, 401 U.S. 986 (1971).*

n9 See *Allis-Chalmers Mfg. Co. v. White Consol. Indus., 414 F.2d 506, 524 (3d Cir. 1969),* cert. denied, *396 U.S. 1009 (1970).*

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VOLUME 2A

PART TWO - Market Structure Issues

CHAPTER 5 - Market Power and Market Definition

5C - Market Definition--General Considerations

Antitrust Law Para. 537

LENGTH: 2090 words

Paragraph 537 - "Significant" Price Increase Required and Defined

TEXT:

537a. Necessary though arbitrary. If the producers of product *A*, united as a hypothetical monopolist, were deemed a "relevant market" when they could profitably raise prices only trivially, say 1 percent, then the power inferred from shares in such a market would be equally trivial. While *all* market power is socially costly, restructuring or controlling every firm that can charge more than the perfectly competitive price would often cost society far more than living with minor power. Moreover, some prices that appear to exceed the competitive level actually reflect a competitive market that is moving toward equilibrium; this happens, for example, when excess demand drives prices up and encourages new entry. Furthermore, some above-cost prices, especially ones that are only modestly so, result from economies of scale or scope, research and development, product differentiation, geographic dispersal of firms, or other factors that are generally desirable or unavoidable.

To infer significant power from market shares, the hypothetically united producers must have the ability to charge significantly more than the perfectly competitive price. Consequently, the P536 price-raising methodology for market definition widens the "provisional" market until the hypothetical monopolist could profitably raise prices significantly and maintain the higher level for a significant period. The government's merger guidelines do the same, finding a market only when the hypothetical monopolist of it could maintain a "small but significant and nontransitory" price increase. Thus, even in implementing the prophylactic function of Clayton Act § 7 to prevent potentially anticompetitive mergers, n1 the government wisely requires significant departures from perfect competition in defining markets and therefore in assessing power. There is even more reason to do so in applying other and less prophylactic provisions of antitrust law.

A "significant" price increase for market definition purposes must be large enough to suggest that antitrust enforcement will be worth its cost and will minimize interference with private activity that is generally desirable or unavoidable though it creates small amounts of market power. At the same time, the number must be sufficiently small to protect consumers from durable threats to their welfare in amounts exceeding enforcement costs.

Unfortunately, neither precedent nor antitrust theory quantifies significance. The merger guidelines speak vaguely of a "small but significant and nontransitory" increase, defining it presumptively as a 5 percent price increase maintained for one year. n2 Any such guide can be fairly criticized, though not fatally.

First, it is inevitably arbitrary, as any number would be, and is not assuredly superior to a smaller or larger standard. Nevertheless, some presumptive test is needed to define that grouping of firms within which significant anticompetitive results are possible. Without it, litigation would become even more complicated, as parties argued about the criterion for market definition, and less consistent, as different courts applied different tests. Because the antitrust tribu-

nal is not capable of setting the "right" criterion for each case, a rough general criterion is administratively necessary even though any test will be unduly generous to defendants in some cases and unduly prohibitive in others.

Second, a different test might better illuminate the potential threat to consumers in a particular case, as discussed in Pc. The government recognizes this and warns that at times it "may use a price increase that is larger or smaller than five percent." n3 It clearly intends, however, that 5 percent be used as a presumptive benchmark. While making any general test presumptive rather than absolute reserves the possibility of varying it when particular circumstances suggest a better test, departures will be rare, for we have no very good calculus for adjusting the test of significance from market to market. Attempting to do so would merely create an illusion of accuracy by complicating an area of litigation that is already complex.

Third, the certainty provided by a general test is somewhat illusory. Even if strong rebuttals to the presumption are not offered in many cases, the data needed for applying the standard with certainty often are unavailable. Nevertheless, such a standard increases predictability significantly and thus helps business firms plan, lawyers advise, prosecutors decide, and tribunals judge.

537b. Five percent or 10 percent test. What should be the size of the hypothetical price increase that defines market boundaries under the P536 methodology? The 5 percent test of the government's merger guidelines is not assuredly better than, say, a 10 percent test. The proper choice between such numbers depends in part on the base for the hypothetical price increase.

The theoretically correct base is the perfectly competitive price at marginal cost, which is often well under the current price. Indeed, prevailing prices generally exceed marginal cost by 5 percent or more among even moderately concentrated producers of differentiated products. n4 In such areas, a 5 percent test would make each narrow class of product, or perhaps each firm, a separate market. Such markets would be unduly narrow and thereby bring close antitrust scrutiny to firms whose above-cost pricing results from such unavoidable or even desirable forces as product differentiation. One might accommodate this concern by applying a 10 percent test to the competitive price but a 5 percent test to prevailing prices. In practice, the two tests can produce similar results. n5

Paradoxically, a 10 percent increase from the competitive price may yield far narrower markets--and thus closer scrutiny of mergers and other conduct potentially threatening consumers--than a 5 percent increase from current prices, for current prices may already be well above competitive levels. As a practical matter, however, the antitrust tribunal will not know the competitive price or the degree to which current prices exceed it and so must *presume* that current prices are more or less competitive. n6 Thus, the enforcement authorities will find themselves accepting current prices as presumptively competitive or simply as the only base to which the price-increasing methodology can be applied in most cases. On that base, the government's 5 percent test seems more appropriate than, say, a 10 percent test.

The occasional tribunal, with reasonable confidence that the current price of product *A* is at or near marginal costs, should ask whether a hypothetical *A* monopolist could maximize profits by increasing price at least 10 percent. Still, we emphasize that the 5 percent test of significance will govern the great preponderance of cases.

537c. Varying the test by markets. As a general matter, setting the presumptive test of significance or varying it by reference to its social cost or profitability in each market brings more complexity than accuracy. Nevertheless, we pause to recognize that a given price increase affects consumers and producers differently in different market circumstances.

537c1. Market size. A 5 percent increase in a large market such as oil or wheat sacrifices much more consumer welfare--whether measured either by "deadweight loss" n7 or by the aggregate overcharge paid by consumers--than a larger increase in the smaller universe of a rural movie theater. Moreover, enforcement costs per unit of consumer welfare are generally much lower in the first situation than in the second. While absolute enforcement costs may be greater in the larger market, they are unlikely to be proportional to the relative social cost of the two situations.

We might be tempted, therefore, to use a 5 percent test for oil and a 20 percent test for small-town theaters. More generally, a smaller number could be used when annual sales in a "provisional" market aggregate, say, $ 500 million; one might start with a 3 percent test of significance and increase it by one percentage point for every $ 50 million of sales. Of course, such criteria are themselves arbitrary and would be controverted in every case, thus raising the already high levels of uncertainty in market definition.

537c2. Relative profitability. A hypothetical price increase of a given percentage will raise profits, for otherwise the firms in the provisional market would not raise prices in the first place. The degree to which profits rise will vary among

industries. The volume lost as a result of the hypothetical price increase will differ, as will the response of costs to that decline in output. And even if accounting profits were uniformly affected in all industries by a profitable price rise of a given percentage, *economic* profits--earnings beyond those necessary to attract capital to the industry n8 --and profit rates will vary as risk and the cost of capital vary.

Even if profits were our central concern, we again see that adjusting the test of "significance" for market definition purposes to reflect an industry's economic profits seems impractical.

537d. Consumer impact; degrees of proximity. Whatever the numerical threshold of significance, the firms in markets defined this way might succeed in raising prices almost to the threshold--whether 5 percent above current prices or 10 percent above the competitive price. For example, suppose that two firms make product *A*, that they propose to merge, that a 4 percent price increase would be highly profitable, that a 5 percent increase would be unprofitable because of buyers' shifts to product *B*, that 100 percent of *A* production amounts to only 10 percent of an unconcentrated *A* + *B* market, and that antitrust enforcers would approve such a 10 percent merger. In this instance, testing market boundaries by a 5 percent price-increase methodology would probably lead to a 4 percent price increase.

Nevertheless, choosing the larger market will seldom actually lead to monopoly pricing within the smaller universe. There may be multiple firms, not all of whom are merging, joining a cartel, or effectively coordinating prices. n9 Moreover, to say that a 5 percent price increase is unprofitable is hardly to say that a 4 percent price increase would always be profitable.

One situation, however, may seem especially troublesome. n10 Suppose that a dozen similar producers of a product could, if united in a cartel, maximize profits by raising prices 5 percent above prevailing levels (or 10 percent above competitive levels or whatever threshold of significance may be adopted). Suppose further that these firms make differentiated products within this single market and that the *A* and *B* versions differ modestly from each other but more substantially from those of the other 10 firms. n11 Of course, if the product differences allowed a hypothetical *A-B* cartel to raise prices 5 percent above prevailing levels without losing too much business to the other 10, those two firms would constitute the market. If not, a single market embraces the dozen firms. Obviously, however, firm *A's* merger with *B* is far more troublesome than its merger with one of the other 10 firms, for an *A-B* merger eliminates the closest competition that each had faced and may enable them to raise prices regardless of what the other firms do.

Thus, the *hypothetical* significant price-increasing methodology for defining a market might mislead antitrust authorities into approving arrangements creating unusual risks of *actual* price increases just short of the significance threshold. But adjusting for this risk via market definition requires more data and precision than are realistically available in most situations. Accordingly, this risk should be taken into account in applying substantive antitrust rules rather than in market definition. n12

SUPPLEMENT: 537a. Necessary though arbitrary. Antitrust deems all the producers of products that are reasonable substitutes for each other to be a relevant market if, when united by a cartel, they could profitably impose a "significant" price increase above the competitive level. But what constitutes significance? If our standard was a one percent price increase, then markets would be very small and power readily found. To be sure, *all* market power is socially costly. Nevertheless, restructuring or controlling every firm that can charge more than the perfectly competitive price would often cost society far more than living with minor power. Moreover, some prices that appear to exceed the competitive level actually reflect a competitive market moving toward equilibrium -- for example, excess demand drives prices up and encourages new entry. Furthermore, some above-cost prices, especially those that are only modestly so, result from economies of scale or scope, research and development, product differentiation, geographic dispersal of firms, high fixed costs, or other factors that are generally desirable or unavoidable in the economy.

To infer significant power from market shares, the hypothetically united producers must have the ability to charge significantly more than the perfectly competitive price. Consequently, the price-raising methodology for market definition described in the previous Paragraph widens the "provisional" market until the hypothetical monopolist could profitably raise prices significantly and maintain the higher level for a significant period. The government's merger guidelines do the same, finding a market only when the hypothetical monopolist of it could maintain a "small but significant and nontransitory increase in price" ("SSNIP"). Thus, even in implementing the prophylactic function of Clayton Act §7 to prevent potentially anticompetitive mergers, n1 the government wisely requires significant departures from perfect competition in defining markets and therefore in assessing power. There is even more reason to do so in applying other and less prophylactic provisions of antitrust law.

n1 See Ch. 9A.

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A "significant" price increase for market definition purposes must be large enough to suggest that antitrust enforcement will be worth its cost while minimizing interference with private activity that is generally desirable or unavoidable though it creates small amounts of market power. At the same time, the number must be sufficiently small to protect consumers from durable threats to their welfare in amounts exceeding enforcement costs. n2

n2 We thus question the reasoning of *Endsley v. City of Chicago*, 230 F.3d 276 (7th Cir. 2000), which concluded that the complaint failed to allege facts required to establish a relevant market of "high-speed limited access routes connecting Chicago to Indiana." The court stated:

> At least two alternate routes, the Borman/Kingery/Bishop Ford Expressway and the Tri-State Tollway, "compete" with the Skyway. While the Skyway may be the more desirable route, it is not the only high-speed roadway between Chicago and the Indiana Tollway. If the Skyway tolls become too high, drivers will take one of the alternate routes. The availability of these very viable options for a high-speed access route linking Chicago to Indiana indicates that the City does not have monopoly power over the relevant market.

Id. at 283. But that ignores the question of *how much* the Chicago Skyway tolls would have to rise. The two alternative routes were not in the same market unless the competition was sufficient to hold Skyway tolls reasonably close to costs. The opinion suggested that the Skyway might be "more desirable" than the alternatives, but did not say by how much. As Judge Hand explained already in *Alcoa*, "substitutes are available for almost all commodities, and to raise price is enough to evoke them." *United States v. Aluminum Co. of Am.*, 148 F.2d 416, 426, 432 (2d Cir. 1945). In this case, the *Endsley* court was very likely impelled by profound doubts as to the existence of any antitrust violation.

In fact, the question of the Chicago Skyway's market power could be very difficult to answer. First, the Skyway is a product that has very high fixed costs (the road itself) in relation to variable costs (maintenance and operation). As a result, prices reasonably calculated to yield a profitable return on investment would have to be significantly higher than short-run marginal cost. Second, current tolls might already be monopoly prices, leading to overstatement of the market if the fact finder queried only about driver responses to a still further price increase. See P539.

Unfortunately, neither precedent nor antitrust theory quantifies significance. The 1992 Horizontal Merger Guidelines speak vaguely of a "small but significant and nontransitory" increase, defining it presumptively as a 5 percent price increase maintained for one year. n3 Any such guide can be fairly criticized, though not fatally.

n3 1992 Horizontal Merger Guidelines §1.11. The Agencies' Commentary on the Horizontal Merger Guidelines says nothing more except to reiterate that "the Agencies generally use a price increase of five percent." United States Dept. of Justice and Federal Trade Commission, Commentary on the Horizontal Merger Guidelines, §1 (March 2006), available at *http://www.ftc.gov/os/2006/03/CommentaryontheHorizontalMergerGuidelinesMarch2006.pdf*.

The 1982 Guidelines, §2.11, explicitly incorporated a 5 percent test. See 4 Trade Reg. Rep. P13,103 at 20,557 (1994). Apparently stung by charges of arbitrariness, the 1984 revised Guidelines §2.11 & n.7 retreated to the "small but significant and non-transitory" formula, although the government actually continued applying a 5 percent test in most circumstances. See Robert Pitofsky, New Definitions of Relevant Market and the Assault on Antitrust, 90 Col. L. Rev. 1805, 1819 (1990); John D. Briggs & Stephen Calkins, Antitrust 1986-1987: Power and Access (Part I), 32 Antitrust Bull. 275, 305 (1987). In the 1992 Guidelines the presumptive 5 percent figure is maintained but the duration of the price increase is stated to be "the foreseeable future."

First, it is inevitably arbitrary, as any number would be, and is not assuredly superior to a smaller or larger standard. Nevertheless, some presumptive test is needed to define that grouping of firms within which significant anticompetitive results are possible. Without it, litigation would become even more complicated as parties argued about the criterion for market definition and less consistent as different courts applied different tests. Because the antitrust tribunal is not capable of setting the "right" criterion for each case, a rough general criterion is administratively necessary even though any test will be unduly generous to defendants in some cases and unduly harsh in others.

Second, a different test might better illuminate the potential threat to consumers in a particular case, as discussed in Pc. The government recognizes this and warns that at times it "may use a price increase that is larger or smaller than five percent." n4 Nevertheless, it clearly intends the 5 percent number to be a presumptive benchmark. While making any general test presumptive rather than absolute reserves the possibility of varying it when particular circumstances

suggest a better test, departures will be rare, for we have no very good calculus for varying the test of significance from market to market. Attempting to do so would merely create an illusion of accuracy by complicating an area of litigation that is already complex.

n4 1992 Guidelines §1.11.

Third, the certainty provided by a general test is somewhat illusory. Even if strong rebuttals to the presumption are not offered in many cases, the data needed for applying the standard with certainty are not often available. Nevertheless, such a standard increases predictability significantly and thus helps business firms plan, lawyers advise, prosecutors decide, and tribunals judge.

537b. Five or ten percent test. The 5 percent test of the government's merger Guidelines is not assuredly better than, say, a 10 percent test. The proper choice between such numbers depends in part on the base for the hypothetical price increase.

The theoretically correct base is the perfectly competitive price at marginal cost, which is often well under the current price. Indeed, prevailing prices generally exceed marginal cost by 5 percent or more among even moderately concentrated producers of differentiated products. n5 In such areas, a 5 percent-above-marginal-cost test for market definition would make each narrow class of product, or perhaps each firm, a separate market. Such markets would be unduly narrow and thereby bring close antitrust scrutiny to firms whose above-cost pricing results from such unavoidable or even desirable forces as product differentiation. One might accommodate this concern by applying a 10 percent test to the competitive price but a 5 percent test to prevailing prices.

n5 See Robert E. Hall, The Relation Between Price and Marginal Cost in U.S. Industry, 96 J. Pol. Econ. 921 (1988). For empirical work involving British industry, see Jonathan Haskel, Christopher Martin, & Ian Small, Price, Marginal Cost and the Business Cycle, 57 Oxford Bull. Econ. & Stat. 25 (1995) (finding significant price/marginal cost disparities in concentrated industries, and higher disparities as the industries become more concentrated).

Paradoxically, a 10 percent increase from the *competitive* price may yield far narrower markets -- and thus closer scrutiny of mergers and other conduct potentially threatening consumers -- than a 5 percent increase from current prices, for current prices may already be well above competitive levels. In many cases, however, the antitrust tribunal will not know the competitive price or the degree to which current prices exceed it and so must *presume* that current prices are more or less competitive. n6 Thus the enforcement authorities will find themselves accepting current prices as presumptively competitive or simply as the only base to which the price-increasing methodology can be applied in most cases. On that base, the government's 5 percent test seems more appropriate than, say, a 10 percent test.

n6 In P539 we explain how current prices (or elasticities) can lead to overly broad market definitions, the presumption that current prices are competitive, and the kinds of evidence that might overcome the presumption.

537c. Varying the test by markets. As a general matter, setting the presumptive test of significance or varying it by reference to its social cost or profitability in each market brings more complexity than accuracy. Nevertheless, we pause to recognize that a given price increase affects consumers and producers differently in different market circumstances.

537c1. Market size. A 5 percent increase in a large market such as oil or wheat sacrifices much more consumer welfare -- whether measured by "deadweight loss" n7 or by the aggregate overcharge paid by consumers -- than a larger increase in the smaller universe of a rural movie theater. Moreover, enforcement costs per unit of consumer welfare are generally much lower in the first situation than in the second. While absolute enforcement costs may be greater in the larger market, they are unlikely to be proportional to the relative social cost of the two situations.

n7 See P502.

We might be tempted, therefore, to use a 5 percent test for oil and a 20 percent test for small-town theaters. More generally, a smaller number could be used when annual sales in a "provisional" market aggregate, say, $ 500 million; or one might start with a 3 percent test of significance and increase it by one percentage point for every $ 50 million in sales. Of course, such criteria are themselves arbitrary and would be controverted in every case, thus adding uncertainty to already high levels of uncertainty in market definition. On balance, varying the size of the price increase by the size of the market does not seem advisable.

537c2. Relative profitability. A hypothetical price increase of a given percentage will raise profits, for otherwise the firms in the provisional market would not raise prices in the first place. However, the degree to which prices and profits

rise will vary among industries. The volume lost as a result of the hypothetical price increase will also differ depending on the situation, as will the response of costs to that decline in output. And even if accounting profits were uniformly affected in all industries by a profitable price rise of a given percentage, *economic* profits -- earnings beyond those necessary to attract capital to the industry -- and profit rates will vary as risk and the cost of capital vary.

Even if profits were our central concern, we again see that varying the test of "significance" for market definition purposes with an industry's economic profits seems impractical.

537d. Consumer impact; degrees of proximity. Whatever the numerical threshold of significance, the firms in markets defined this way might succeed in raising prices almost to the threshold -- whether 5 percent above current prices or 10 percent above the competitive price. For example, suppose that two firms make product *A*, that they propose to merge, and that a 4 percent price increase would be highly profitable but a 5 percent increase would not because of buyers' shifts to product *B*. Further, the *B* market is ten times larger than the *A* market. In this instance, testing market boundaries by a 5 percent price-increase methodology would lead to a market including *B*, and approval of the merger; the result would be a 4 percent price increase for *A*.

Nevertheless, choosing the larger market will seldom actually lead to monopoly pricing within the smaller universe. There may be multiple firms there, not all of whom are merging, joining a cartel, or effectively coordinating prices. n8 Moreover, to say that a 5 percent price increase is unprofitable is hardly to say that a 4 percent price increase would always be profitable.

n8 Such qualifications may underlie the insistence of 1992 merger Guidelines § 1.0 that its 5 percent methodology is not approval or toleration of lesser price increases.

However, one situation is troublesome. n9 Suppose that the dozen similar producers of a product could, if united in a cartel, maximize profits by raising prices 5 percent about prevailing levels (or 10 percent above competitive levels, or whatever threshold of significance may be adopted). Suppose further that these firms make differentiated products within this single market and that the *A* and *B* versions differ modestly from each other, but more substantially from those of the other ten firms. n10 Of course, if the product differences allowed a hypothetical *A-B* cartel to raise prices 5 percent above prevailing levels without losing too much business to the other ten, those two firms would constitute the market. If not, a single market embraces the dozen firms. Obviously, however, firm *A's* merger with *B* is far more troublesome than its merger with one of the ten other firms, for an *A-B* merger eliminates the closest competition that each had faced and may enable them to raise prices regardless of what the other firms do. Antitrust policy takes such mergers into account by testing whether a "unilateral" (rather than a marketwide) price increase might be profitable following the merger. n11

n9 See Harold Hotelling, Stability in Competition, 39 Econ. J. 41 (1929); Jonathan Baker & Timothy F. Bresnahan, The Gains from Merger or Collusion in Product-Differentiated Industries, 33 J. Indus. Econ. 427, 429 (1985); Thomas J. Campbell, Predation and Competition in Antitrust: The Case of Nonfungible Goods, 87 Col. L. Rev. 1625, 1636 (1987).

n10 The analysis is the same when transport costs are significant and the two firms are located near each other but rather far from the others, though still in the same market.

n11 See P914.

FOOTNOTES:

n1 See Ch. 9A.

n2 1992 Horizontal Merger Guidelines § 1.11. 1982 Guidelines § 2.11 explicitly incorporated a 5 percent test. See 4 *Trade Reg. Rep. P13,103, at 20,557 (1994)*. Apparently stung by charges of arbitrariness, 1984 Guidelines § 2.11 & n.7 retreated to the "small but significant and non-transitory" formula, although the government actually continued applying a 5 percent test in most circumstances. See A. Briggs & S. Calkins, Antitrust 1986-1987: Power and Access (Part I), *32 Antitrust Bull. 275, 305 (1987);* R. Pitofsky, New Definitions of Relevant Market and the Assault on Antitrust, *90 Colum. L. Rev. 1805, 1819 (1990)*. In the 1992 guidelines the presumptive 5 percent figure is maintained but the duration of the price increase is stated to be "the foreseeable future."

n3 1992 Horizontal Merger Guidelines § 1.11.

n4 See R. Hall, The Relation Between Price and Marginal Cost in U.S. Industry, 96 J. Pol. Econ. 921 (1988).

n5 To overstate the similarity: if prices generally exceeded the competitive level by 5 percent, a hypothetical 5 percent increase in current prices approximates a 10 percent increase above the competitive level.

n6 In P539 we explain how current prices (or elasticities) can lead to overly broad market definitions, the presumption that current prices are competitive, and the kinds of evidence that might overcome the presumption.

n7 See P502.

n8 See P520.

n9 Such qualifications may underlie the insistence of the 1992 Horizontal Merger Guidelines § 1.0 that its 5 percent methodology does not represent approval or toleration of lesser price increases.

n10 See J. Baker and T. Bresnahan, The Gains from Merger or Collusion in Product-Differentiated Industries, 33 J. Indus. Econ. 427, 429 (1985); T. Campbell, Predation and Competition in Antitrust: The Case of Nonfungible Goods, *87 Colum. L. Rev. 1625, 1636 (1987);* H. Hotelling, Stability in Competition, 39 Econ. J. 41 (1929).

n11 The analysis is the same when transport costs are significant and the two firms are located near each other but rather far from the others, though still in the same market.

n12 The government's 1992 Horizontal Merger Guidelines § 2.2 does just that. It suggests challenges to certain mergers between the most proximate (in product or geographic terms) firms within a market that might bring them the power to increase prices unilaterally even when other firms in the market do not raise prices. See P901'd.

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INCORPORATING DYNAMIC EFFICIENCY CONCERNS IN MERGER ANALYSIS: THE USE OF INNOVATION MARKETS

RICHARD J. GILBERT
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I. INTRODUCTION

Economic progress depends on a steady stream of innovation. In his classic study of the determinants of economic growth,[1] Robert M. Solow concluded that most of the source of economic growth in the United States in the first half of this century could be explained by investments in research and development and education rather than by increases in capital and labor. Solow's findings have been revisited many times,[2] and while some disagree about the quantitative effects of research and development spending on economic activity, there is general agreement that such effects are substantial.

Despite the importance of R&D for economic performance, the antitrust laws, and merger enforcement in particular, have not focused sufficiently on the consequences of market power for the pace of industrial innovation. This article reviews the economic literature on the effects of competition on innovation and describes how innovation can be incorporated into the analysis of mergers and acquisitions.[3] We propose that

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[1] Robert M. Solow, *Technical Change and the Aggregate Production Function*, 39 REV. ECON. & STAT. 312 (1957).

[2] *See, e.g.*, EDWARD F. DENISON, TRENDS IN AMERICAN ECONOMIC GROWTH, 1929–1982 (1985); Zvi Griliches, *Productivity, R&D, and Basic Research at the Firm Level in the 1970's*, 76 AM. ECON. REV. 141 (1986).

[3] This article deals primarily with the effects of mergers on innovation, but the principles apply also to joint ventures and other combinations involving research and development.

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delineating innovation markets can be a valuable instrument for evaluating the effects of merger-induced structural changes on the incentives for research and development and the resulting pace of industrial innovation.

The impact of a merger on innovation can be analyzed as competitive effects in downstream product markets or as the consequence of structural effects in upstream innovation markets. The former approach may fail to capture many of the consequences of altered innovation effort if, as under traditional merger analysis, attention is restricted to product markets where the merging firms were actual or potential competitors prior to the merger. A merger that has adverse effects on innovation could affect prices and products in markets where the merging firms do not compete premerger and even in markets where the merging firms are not likely potential competitors. The Antitrust Division of the Department of Justice alleged such effects in its recent complaint against the acquisition by ZF Friedrichshafen of the Allison Transmission Division of the General Motors Corporation.[4]

A reduction in innovation may delay improvements in production processes that would lower the production costs of each of the merging firms, or it may reduce the magnitude of such improvements. In addition, a reduction in innovation may reduce the likelihood of discovery or delay the introduction by each firm of new or improved products. The loss of production improvements would result in higher costs, and possibly higher prices, even in markets where only one of the merging firms is a participant. Similarly, the loss of new or improved products would deny consumers the benefits of these improvements in every market where the firm is a supplier, including markets where only one of the firms is a participant.

A focus on innovation markets also facilitates analysis of the effects of a merger or acquisition on potential competition. Innovation resulting from vigorous research and development is often the precursor to entry in markets characterized by sophisticated and rapidly evolving technology. A merger or acquisition that adversely affects innovation, therefore, may reduce the probability of entry into and the intensity of competition in markets where the merging firms do not compete prior to the merger. These effects follow from changes in the current state of actual (not potential) competition in innovation markets. The Federal Trade Commission focused in part on the consequences of structural change in

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[4] United States v. General Motors Corp., No. 93-530 (D. Del. filed Nov. 16, 1993).

innovation for the state of future competition in its challenge of Genentech's acquisition by Roche Holding.[5]

Innovation raises competition issues in three distinct categories of product markets: markets for existing products, the R&D process itself, and markets for future products.[6] Other articles have focused on the effects of innovation as a source of new competition for existing products[7] and on the effects of innovation for competition in new products.[8] This article explores the theoretical value and practical utility of innovation markets. The focus is primarily on the use of innovation markets to analyze the effects of a merger on competition in research and development and on the consequences of such competition for the prices, costs, and availability of downstream products.

Part II considers innovation as a type of nonprice competition and weighs the reasons for and against a more thorough treatment of nonprice competition in merger enforcement. Part III reviews the theoretical literature and the empirical evidence on the relationship between market structure and the pace of innovation. Part IV provides an analysis of the competitive effects of a merger involving research and development through the use of an illustrative example. Part V highlights the conditions under which the innovation markets approach is likely to aid merger enforcement. Part VI provides a guide to innovation market definition and merger analysis. Part VII discusses the use of the innovation markets framework under Section 7 of the Clayton Act. The concluding section urges the use of the innovation markets approach to facilitate the evaluation of the competitive effects of a merger on dynamic efficiency.

II. MERGERS AND NONPRICE COMPETITION

Section 7 of the Clayton Act prohibits a merger or acquisition whose effect "may be substantially to lessen competition, or tend to create a monopoly."[9] In applying this provision of the antitrust laws, the Antitrust Division and the FTC have traditionally interpreted the lessening of

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[5] Roche Holding Ltd., [1987–1993 Transfer Binder] Trade Reg. Rep. (CCH) ¶ 22,879 at 22,563 (1990).

[6] See William F. Baxter, *The Definition and Measurement of Market Power in Industries Characterized by Rapidly Developing and Changing Technologies*, 53 ANTITRUST L.J. 717 (1984).

[7] See, e.g., Raymond S. Hartman et al., *Assessing Market Power in Regimes of Rapid Technological Change*, in INDUS. & CORP. CHANGE (forthcoming); Thomas M. Jorde & David J. Teece, *Innovation and Cooperation: Implications for Competition and Antitrust*, 4 J. ECON. PERSP., Summer 1990, at 75.

[8] See, e.g., Joseph Kattan, *Antitrust Analysis of Technology Joint Ventures: Allocative Efficiency and the Rewards of Innovation*, 61 ANTITRUST L.J. 937 (1993); and *Beyond the SSNIP: A Look at Innovation Competition*, INT'L MERGER L. 5 (1992).

[9] 15 U.S.C. § 18.

competition to refer to effects of the combination on price in a relevant product and geographic market.[10] Yet competition has many dimensions of which price is only one. These other dimensions include the diversity and quality of the products, promotional effort, and pre-sale and post-sale services. Innovation, of course, is another type of nonprice competition. In this part we consider the reasons for and against a more thorough treatment of nonprice competition in merger enforcement.[11]

Antitrust analysis typically does not dwell on the nonprice aspects of competition. One reason is the difficulty of assessing consumer benefits from particular forms of nonprice competition. Other things being equal, consumers are unambiguously better off with lower prices. Whether consumers benefit from advertising and marketing expenditures, however, is unclear. Some argue that advertising competition distorts consumer preferences and leads to higher prices with no compensating benefits.[12] Others stress the informative value of advertising.[13] Sorting out the useful messages in an advertisement from those that merely alter consumer choices would be a daunting task.

Even when consumers unambiguously prefer more of some nonprice attribute of a product, the net effect on consumers is indeterminate when costs are taken into account. For example, even though consumers value greater product diversity, competition among firms to win consumers by providing a greater number of products can result in higher costs that make consumers worse off overall.[14] Even product quality has uncertain consequences for consumer welfare. All consumers may agree that higher quality products are better than lower quality ones. Some

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[10] U.S. Department of Justice and Federal Trade Commission Horizontal Merger Guidelines (1992), *reprinted in* 4 Trade Reg. Rep. (CCH) ¶ 13,104 [hereinafter 1992 Merger Guidelines] state as their unifying theme that "mergers should not be permitted to create or enhance market power or to facilitate its exercise," where "[m]arket power to a seller is the ability profitably to maintain prices above competitive levels for a significant period of time." *Id.* at 20,570–71.

[11] See Dennis A. Yao & Susan S. DeSanti, *Innovation Issues Under the 1992 Merger Guidelines*, 61 ANTITRUST L.J. 505 (1993), for work related to this discussion. Yao and DeSanti emphasize how innovation may be treated under the 1992 Horizontal Merger Guidelines, whereas the focus of this article is more on the benefits and problems of defining innovation markets.

[12] Avinash K. Dixit & Victor D. Norman, *Advertising and Welfare*, 9 BELL J. ECON. 1 (1978).

[13] *See, e.g.*, Lee Benham, *The Effect of Advertising on the Price of Eyeglasses*, 15 J.L. & ECON. 337 (1972); Carl Shapiro, *Advertising and Welfare: Comment*, 11 BELL J. ECON. 749 (1980).

[14] *See, e.g.*, GEORGE W. DOUGLAS & JAMES C. MILLER III, ECONOMIC REGULATION OF DOMESTIC AIR TRANSPORT: THEORY AND POLICY (1974); Avinash K. Dixit & Joseph E. Stiglitz, *Monopolistic Competition and Optimum Product Diversity*, 67 AM. ECON. REV. 297 (1977).

consumers, however, may prefer to consume lower quality goods at lower prices than higher quality goods at higher prices.[15]

For many years, innovation shared the general neglect bestowed by antitrust authorities on other forms of nonprice competition. However, innovation's crucial role in generating economic growth and in enhancing global competitiveness warrants a more central role in antitrust analysis. The domestic economy can continue to expand only if it succeeds in producing either new products that consumers desire or existing products at lower costs. In the language of welfare economics, a reduction in cost typically has a greater welfare consequence than an equal reduction in price. A reduction in price increases total economic welfare (the sum of the economic benefits to consumers and producers) only to the extent that it increases output. The change in price by itself is a transfer of economic benefits between consumers and producers, with no direct impact on the total. A reduction in cost has a direct benefit by freeing resources that can be used elsewhere in the economy. In addition, a reduction in cost increases economic welfare if it results in lower prices and greater output.[16]

Compared to many other forms of nonprice competition, it is easier to show that consumers benefit from increased innovation. Innovation generates new products that consumers can enjoy, and consumers will buy the new products only if they provide net positive surplus. Thus, consumers are strictly better off with more product innovation, provided that there is no reduction in the supply or increase in the price of other products or services. Consumers are also better off, or at least no worse off, when innovation leads to less expensive products or cheaper means of manufacture.

It is conceivable that firms might squander resources in costly innovation races that lead to increased costs. Wasteful innovation competition could translate into higher prices that consumers must ultimately pay to subsidize costly research budgets. The available empirical evidence,[17]

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[15] See A. Michael Spence, *Product Differentiation and Welfare*, 66 AM. ECON. REV. 407 (1976).

[16] To the extent that the welfare effects of a merger are more closely approximated by its impact on consumers alone, the quantitative significance of a change in price would be more similar to the effects of an equal change in cost. Nevertheless, the conclusion that there is a direct impact on economic performance from an activity that affects costs or the generation of new products is inescapable.

[17] See Edwin Mansfield et al., *Social and Private Rates of Return from Industrial Innovations*, 91 Q.J. ECON. 221 (1977) (R&D displays a very high marginal social return). Their work implies that, at the margin, society would be better off with more R&D, although it is not sufficient to determine how much more R&D would be desirable.

however, confirms the conventional wisdom that society is better off with greater investment in research and development.

An antitrust evaluation of nonprice competition under Section 7 of the Clayton Act is complicated not only by the complexity of assessing how consumers value nonprice product characteristics such as product diversity or quality, but also by the difficulty of determining how a merger or acquisition affects their supply. Consider product diversity. Will greater competition cause rival firms to expand their product offerings, or will the constraints of competition force them to specialize in market niches where they can exploit economies of scale? Will more competition improve product quality or post-sale services? The same question applies to the link between competition and innovation, which we address in the next part.

III. MARKET STRUCTURE AND INNOVATION

A. THEORY

The central concern of this article is that a change in market structure resulting from a merger or acquisition may have adverse consequences for the pace of innovation. Others who have written on this subject have stressed the importance of innovation in evaluating competition in product markets.[18] These authors emphasize that the sources of innovation are hard to predict, and that a proper analysis of antitrust markets should account for the many ways that firms may compete with innovative products. They argue for a more expanded view of the potential for entry from successful research and development programs, which limits the exercise of market power. We do not disagree that innovation is an important source of entry. That, however, is not a main subject of this article. We focus instead on the link between market structure and the level of investment in research and development.

While there is little controversy over the value of innovation, the issue of whether more competition leads to greater investment in research and development is much less settled. Joseph A. Schumpeter was a leader among economists who stressed the important role technological innovation plays in capitalist economies. Schumpeter advanced the hypothesis that there exists a causal connection between market concentration and the pace of technological innovation.[19] At the heart of Schumpeter's

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[18] See, e.g., Hartman et al., supra note 7; Jorde & Teece, supra note 7.

[19] JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY 106 (1950) ("What we have got to accept is that [the large-scale establishment or unit of control] has come to be the most powerful engine of [economic] progress. . . . In this respect, perfect competition is not only impossible but inferior, and has no title to being set up as a model of ideal efficiency.").

argument is a monopoly's supposed superior ability to absorb the costs and risks of innovative activity.

Kenneth J. Arrow offered a competing hypothesis. He showed in a theoretical model that a monopolist has less incentive to invest in innovation than a new entrant or a firm in a competitive industry.[20] Arrow's model rests on several crucial assumptions. First, the innovation must be related to the existing product or process; otherwise even the monopolist would qualify as a new entrant for the innovation. The innovation considered in Arrow's model is either a product that is a substitute for an existing product or a process that lowers the cost of producing the existing product. Second, the type of market structure that exists prior to the innovation (whether a monopoly or an industry with many firms) does not affect the ability of an innovator to appropriate the value of a new product or process.[21] This assumption would be satisfied by a regime of perfect patent protection for a new product or process. Finally, firms do not differ in the effectiveness of their innovative effort.

Under the assumed conditions, the intuition underlying Arrow's result is straightforward. An innovation benefits a monopolist only to the extent that it increases the ability of the monopolist to extract additional profits from consumers. What deters the monopolist from innovating then is the prospect that the innovation will "cannibalize" the profits from its present monopoly or induce the obsolescence of its existing products. By contrast, a newcomer to the industry, or a firm that operates in a perfectly competitive industry, has no stream of profits that would be displaced by an innovation. The incentive of such firms to invest in innovative effort is the ability to receive the entire value of the innovation.

As an example, suppose a monopolist earns $100 with its present product. Suppose further that a new product or process could increase the return to $150. The return to the monopolist from innovation is $50. A newcomer to the industry could earn as much as $150 if the new product completely displaced the monopolist's existing product. Even if it did not, Arrow showed that the entrant would earn at least $50, which is the value of the innovation to the monopolist, and in many cases the new entrant would earn significantly more.[22]

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[20] Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources to Invention*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY 609–25 (National Bureau of Economic Research ed., 1962).

[21] A process innovation is a new or improved technology that is used in the manufacture of an existing or new product.

[22] Arrow analyzed the example of a process innovation that reduces the cost of making the existing product. In that analysis, the worst case for the newcomer is a post-innovation price equal to the monopolist's pre-innovation cost (any higher price would increase the newcomer's profit). Then, a reduction in cost from the innovation would benefit the

Others have refined and extended Arrow's result that competitive industries have a greater incentive to invest in R&D than do monopolies.[23] In each of these models, the monopolist's prior stream of profits reduces its incentive to innovate. Closely related to this literature are studies that explore the implications of market structure for the rate of innovation in the context of research joint ventures.[24] These analyses also support the conclusion that R&D may suffer in markets characterized by high levels of concentration.

Economic theories provide some indication as to the value of competition in R&D. However, these theories, of which Arrow's and Schumpeter's are two prominent examples, provide a wide range of predictions, making it difficult to make strong conclusions about the relationship between market structure and R&D investment. The impact of competition on innovation furthermore depends on many firm- and industry-specific factors that complicate the task of making such predictions.

B. COMPLICATING FACTORS AND EVIDENCE

A number of complicating factors diminish the value for merger enforcement of theoretical conclusions about the relationship between market structure and the pace of innovation. One of the most important factors is the relationship between market structure and the ability to appropriate the gains from innovation in an economy with imperfect protection for intellectual property. Knowledge, which cannot be directly protected by intellectual property laws, diffuses to competitors and allows them to share in the benefits of an innovation when intellectual property regimes fail to provide complete protection against imitation. Under

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newcomer and the monopolist by the same amount per unit of the product sold. The total benefit to the monopolist would be smaller, however, because the cost reduction would apply to the monopolist's lower output.

[23] See, e.g., Partha Dasgupta & Joseph E. Stiglitz, *Uncertainty, Industrial Structure, and the Speed of R&D*, 11 BELL J. ECON. 1 (1980); Tom K. Lee & Louis L. Wilde, *Market Structure and Innovation: A Reformulation*, 94 Q.J. ECON 429 (1980); Glenn C. Loury, *Market Structure and Innovation*, 93 Q.J. ECON 395 (1979); Jennifer F. Reinganum, *The Timing of Innovation: Research, Development, and Diffusion*, in HANDBOOK OF INDUSTRIAL ORGANIZATION 849 (Richard L. Schmalensee & Robert D. Willig eds., 1989).

[24] See, e.g., Gene M. Grossman & Carl Shapiro, *Research Joint Ventures: An Antitrust Analysis*, 2 J.L. ECON. & ORG. 315 (1986); Michael L. Katz, *An Analysis of Cooperative Research and Development*, 17 RAND J. ECON. 527 (1986); Michael L. Katz & Janusz A. Ordover, *R&D Cooperation and Competition*, BROOKINGS PAPERS ON ECONOMIC ACTIVITY: MICROECONOMICS 137 (Martin N. Bailey & Clifford Winston eds., 1990); Joseph Kattan, *Antitrust Analysis of Technology Joint Ventures: Allocative Efficiency and the Rewards of Innovation*, 61 ANTITRUST L.J. 937 (1993); Janusz A. Ordover & William J. Baumol, *Antitrust Policy and High-Technology Industries*, OXFORD REV. ECON. & POL., Winter 1988, at 13; Janusz A. Ordover & Robert D. Willig, *Antitrust for High-Technology Industries: Assessing Research Joint Ventures and Mergers*, 28 J.L. & ECON. 311 (1985); Carl Shapiro & Robert D. Willig, *On the Antitrust Treatment of Production Joint Ventures*, 4 J. ECON. PERSP., Summer 1990, at 113.

these circumstances, a large share of the markets in which an innovation would be used may enable a firm to appropriate more fully the value of its innovative efforts. A monopolist may thus have a greater incentive to innovate than competitive firms, even if the monopolist suffers from the problem of eroding its own profit base or inducing the obsolescence of its existing products.

Another factor complicating the relationship between market structure and the pace of innovation is that many innovations are revolutionary and paradigm shifting.[25] They introduce radically different technologies and are difficult to conceptualize as simple substitutes for existing processes and products. Institutional commitments to existing products or production methods can be as great a factor in the incentive to innovate as the problem of self-induced obsolescence. Such commitments can take the form of firm-specific skills, investments in complementary assets, and simply a preference for established ways of doing business.[26]

Moreover, even if all firms have the same incentive to engage in research and development, it is highly unlikely that all firms are equal in the effectiveness of their innovative efforts. Firms may possess private information about R&D opportunities, or have unique assets that are related to innovation success. Variance in effectiveness also makes it difficult to posit a strong relationship between industry structure and innovation.

Monopoly power may provide a stimulus for innovation in several ways. As discussed above, monopoly may help the inventor to appropriate the benefits of its efforts by limiting the opportunities for diffusion of knowledge to competing firms. Another argument in favor of monopoly is Schumpeter's, that a monopoly may provide a more secure platform to engage in risky R&D investment. A monopolist's access to capital and size may be an advantage in obtaining the needed financing for costly R&D. A well-functioning capital market, however, undercuts the financing argument.

Finally, under some circumstances a monopolist may have a greater incentive to invest in R&D than a new competitor, as a means to protect its monopoly profits. Arrow's analysis of R&D incentives assumed that

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[25] David J. Teece, *Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy*, 15 RES. POL. 285, 287–88 (1986) (discussion of shifts in dominant design).

[26] *See, e.g.*, Rebecca Henderson, *Underinvestment and Incompetence as Responses to Radical Innovation: Evidence from Photolithographic Alignment Equipment Industry*, 24 RAND J. ECON. 248 (1993) (case studies establishing the importance of radical change to institutional investment in innovation).

the monopolist is protected from new competition, perhaps because there are large entry barriers into the monopolist's product market or because the monopolist has a patent that provides a very broad scope of protection. The protected monopolist has less of an incentive to invest in R&D compared to a new entrant or to a firm in a competitive industry because it does not wish to cannibalize its existing products. However, as many dominant producers have discovered in industries ranging from buggy whips to mainframe computers, even an established monopoly is vulnerable to entry through innovation. Although a monopolist has less to gain from innovation, it stands to lose its monopoly profits if a new entrant succeeds in developing a substitute product. The loss to the monopolist from successful entry can exceed the entrant's profits. The monopolist, because it has more to lose than a new rival has to gain from successful entry, can afford to out-bid a new entrant in a race to invent.[27] Investing to out-bid entry would not be a profitable strategy if there were many potential entrants[28] or if the monopolist could not preempt entry with sufficient certainty.[29] In either of these cases, the cost to the monopolist from self-induced obsolescence would dominate the risk of lost profits from entry, and the monopolist would have less incentive to invent than a new entrant.

The intensity of R&D competition prior to the merger and the relative technological competence of the merging partners are also complicating factors. Consider as an example an industry in which costs are strongly influenced by production experience or other learning. The effects on innovation of a merger or acquisition depend on the relative capabilities of the merging partners. A merger that removes a competitor that is far behind on the learning curve may have little significance for the pace of R&D, while the loss of a competitor at the forefront of innovation could have very substantial consequences for market performance.[30]

The next set of complicating factors derives from the possibility that a particular merger may actually enhance the efficiency of research and development. First, the merger may eliminate unnecessary duplication of R&D and thereby reduce the costs of innovation. Firms pursuing

[27] See Richard J. Gilbert, *Patents, Sleeping Patents, and Entry Deterrence*, in STRATEGY, PREDATION, AND ANTITRUST ANALYSIS 205 (Steven C. Salop ed., 1981); Richard J. Gilbert & David M.G. Newbery, *Preemptive Patenting and the Persistence of Monopoly*, 72 AM. ECON. REV. 514 (1982).

[28] See Gilbert, *supra* note 27; Gilbert & Newbery, *supra* note 27.

[29] See Jennifer F. Reinganum, *Uncertain Innovation and the Persistence of Monopoly*, 73 AM. ECON. REV. 741 (1983).

[30] See, e.g., Drew Fudenberg, Richard J. Gilbert, Joseph E. Stiglitz & Jean Tirole, *Preemption, Leapfrogging and Competition in Patent Races*, 22 EUR. ECON. REV. 3 (1983).

independent R&D programs may be engaged in some activities that are redundant. On the other hand, research programs that appear to be redundant may hide important differences, and combining such programs may risk the elimination of an alternative path of discovery. For example, petroleum exploration companies often survey the same prospects, yet some succeed while others fail. Second, the merger may help exploit scale economies in R&D. Finally, the merging firms may own complementary R&D assets and the union of these firms may raise the quality or lower the cost of innovative activity.[31]

The lack of a deterministic relationship between R&D expenditure and innovation makes it more difficult to link market structure and the pace of technological innovation. While R&D spending may be necessary for innovation, it is anything but sufficient. This is especially true of more fundamental innovations. The link between market structure and innovation is further weakened by the inability to identify without error the direction of the chain of causation. While market structure may affect the pace of innovation, innovation also shapes market structure. Failure to get the direction of causation right undercuts the strength of any conclusion about the relationship between industry structure and innovative efforts.

The results of statistical analyses of the relationship between innovation and market structure are provocative, but generally not conclusive. Such studies are complicated by the many factors mentioned above. Based on 1960 data for fifty-six manufacturing groups, F.M. Scherer found that the ratio of the employment of scientists and engineers to firm sales (a measure of R&D intensity) increased with market concentration, but only for moderate levels of concentration. At higher levels of market concentration, increases in concentration were associated with declining R&D intensity.[32] R&D employment is a measure of innovative effort, not of actual innovative output. However, Scherer found no support for a conclusion that larger firms are more effective at translating R&D expenditures into useful inventions.[33] Scherer concluded that "tech-

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[31] Recognizing that combinations of firms may provide superior research and development, Pitofsky has proposed a narrow defense for mergers that facilitate R&D. Robert Pitofsky, *Proposals for Revised United States Merger Enforcement in a Global Economy*, 81 GEO. L.J. 195 (1992).

[32] F.M. SCHERER, INNOVATION AND GROWTH: SCHUMPETERIAN PERSPECTIVES 239–47 (1984).

[33] *Id.* at 237:

> [T]he largest industrial corporations conduct a share of formally organized R&D considerably larger than their share of sales, value added, or employment. . . . What the largest corporations accomplish with their R&D dollars is less impressive. By every measure used, the group of large corporations as a whole contributed

nological vigor appears to increase with concentration mainly at relatively low levels of concentration. When the four-firm concentration ratio exceeds 50 or 55 percent, additional market power is probably not conducive to more vigorous technological efforts and may be downright stultifying."[34]

More recent analyses have, however, challenged these conclusions. Using Federal Trade Commission 1974 line of business data for 437 firms, no significant relationship was found between market structure and R&D intensity after controlling for effects that were specific to firms and their industries.[35] These results have been duplicated by others.[36] Whatever relationship exists at a general economywide level between industry structure and R&D is likely masked by differences across industries in technological opportunities, demand, and the appropriability of inventions.

Industry case studies are another source of evidence on the relationship between market structure and innovation. Based on an international study of the sources of competitive advantage, Michael Porter found that "[R]ivalry has a direct role in stimulating improvement and innovation. . . ."[37] He concluded: "A group of domestic rivals draws attention to the industry, encouraging investments by individuals, suppliers, and institutions that improve the national environment, and creates diversity and incentives to speed the rate of innovation. . . ."[38] Porter's thesis is that firm structure and rivalry interact with the supply of industry factors of production and demand in complex ways that are conducive to technological progress. The presence of these interdependencies likely contributes to the difficulty of uncovering clear conclusions from statistical studies of the relationship between market structure and R&D.

Significant increases in competition resulting from changes in import penetration or other industry shocks have triggered the major restructuring of some industries to achieve lower manufacturing costs and to

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fewer significant innovations, contest-winning technical advances, and invention patents per million dollars of R&D than smaller enterprises.

[34] *Id.* at 247.

[35] JOHN T. SCOTT, PURPOSIVE DIVERSIFICATION AND ECONOMIC PERFORMANCE (1993); *see also Firm Versus Industry Variability in R&D Intensity, in* R&D, PATENTS, AND PRODUCTIVITY 233–40 (Zvi Griliches ed., 1984).

[36] *See* Richard C. Levin et al., *R&D Appropriability, Opportunity, and Market Structure: New Evidence on Some Schumpeterian Hypotheses,* 75 AM. ECON. REV. 20 (1985).

[37] MICHAEL E. PORTER, THE COMPETITIVE ADVANTAGE OF NATIONS 143 (1990).

[38] *Id.* at 144.

develop new and more competitive products.[39] James MacDonald confirmed these observations by analyzing the determinants of the rate of growth of labor productivity (output per hour of labor) in ninety-four industries during the period 1972 through 1987.[40] He found that increases in import penetration had large positive impacts on labor productivity in highly concentrated industries. Using labor productivity as an indicator, albeit imperfect, of technical change, these results imply that a reduction in concentration has significant beneficial impacts for technical progress in markets that are highly concentrated.

Individual circumstances weigh heavily on the likely relation between industry structure and research and development. There is, nonetheless, broad support for Areeda and Turner's admonishment that "[N]either theory nor evidence suggests that *substantial* market power is so generally conducive to technological progress that toleration or encouragement would be desirable,"[41] and there is additional evidence to support the stronger conclusion that protection from competition in inimical to technological progress.

IV. R&D AS AN INPUT TO PRODUCTION

Research and development is an input into the production of final goods and services. Merger analysis, however, is typically performed in the context of the final goods and services themselves. Does the analysis of markets for inputs to production offer potential insights into competitive effects that cannot be gained by focusing solely on output markets?

We answer this question by way of example. Consider an intermediate good such as aluminum ingot used to fabricate aluminum products. Suppose there are two aluminum ingot producers, one in the United States and the other in Europe. They are both vertically integrated suppliers of two final products: aluminum cable and lawn furniture. Both producers compete in a world market for cable. There are separate geographical markets for lawn furniture in the United States and Europe. For analytical convenience, we assume that the world market for cable is comprised of only these two aluminum producers, and that the firms are monopolists in their home markets for lawn furniture. Neither firm

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[39] *See, e.g.,* MICHAEL L. DERTOUZOS ET AL., MADE IN AMERICA: REGAINING THE PRODUCTIVE EDGE (1989) (describing the experience of Xerox, domestic steel and chemical producers, and commercial airline manufacturers to increased competition).

[40] James M. MacDonald, *Does Import Competition Force Efficient Production?*, REV. ECON. & STAT. (forthcoming).

[41] 2 PHILLIP AREEDA & DONALD F. TURNER, ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION 291 (1978).
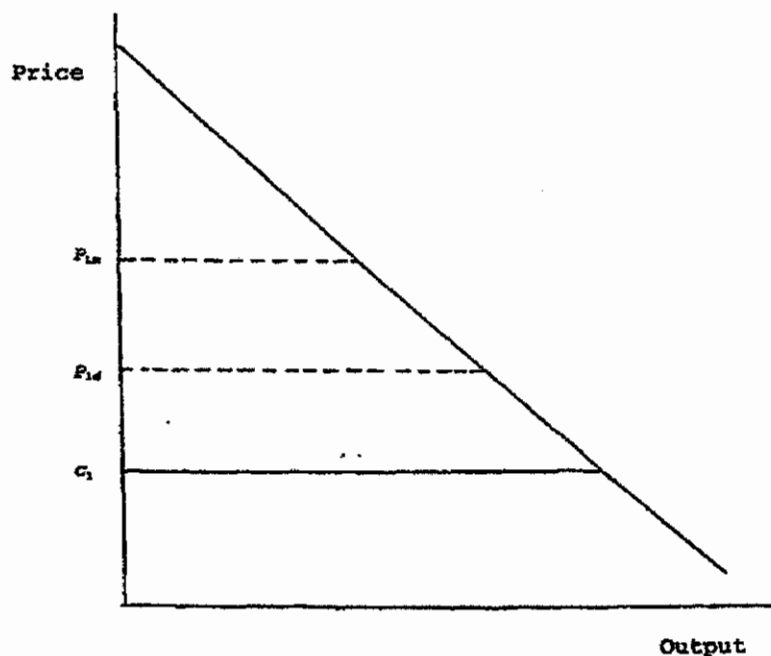
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Figure 1.   Aluminum cable prices pre-merger (P_{1d}) and post-merger (P_{1m}).

is an actual or perceived potential entrant in the other firm's home
market for lawn furniture, or in any other market.

A merger between these two producers would change the structure
of the cable market from a duopoly to a monopoly. The merger would
not affect competition in the markets for lawn furniture. Lawn furniture
would continue to be priced at the premerger monopoly level in each
of the geographic markets. Figure 1 shows the demand for aluminum
cable, with price increasing from the premerger duopoly level of P_{1d} to
the post-merger monopoly level of P_{1d} (where the subscript 1 denotes
the cable product, d stands for duopoly and m for monopoly). The per
unit cost of producing aluminum cable appears in Figure 1 as c_1.

Analyzing a merger downstream at the level of final products (alumi-
num cable and lawn furniture) or upstream at the level of inputs (alumi-
num ingot) yields equivalent results as long as the merger does not
change the cost structure of the merged firm. Focusing solely on the
competitive effects of the merger in downstream product markets,
greater concentration in the cable market from the merger is likely to

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lead to a price increase, from P_{1d} to P_{1m}. The merger would have no structural impact on competition in other markets (lawn furniture) where the firms do not compete.

Focusing instead on the upstream market for aluminum·ingot, the merger would be anticompetitive only to the extent that it would allow the combined firm to increase its market power in cable. Looked at from either the perspective of the input (ingot) market or the downstream product markets (cable and lawn furniture), the merger would have no effect on competition in the markets for lawn furniture or in other markets where the two producers do not compete.[42]

The equivalence of the downstream and upstream analyses breaks down when a merger alters incentives for innovation, which affects the cost structure of the firms or the development of new products.[43] In this instance, downstream output market analysis fails to capture fully all of the economic consequences resulting from the merger. Suppose that the two aluminum producers are engaged in R&D on a more energy-efficient smelting process which, if successful, will reduce the cost of aluminum ingot from c to c' per ton. As a consequence, the per unit cost of aluminum cable would fall from c_1 to c_1', and the per unit cost of aluminum lawn furniture would fall from c_2 to c_2'. Further suppose that there are evidentiary reasons to believe that if the two firms merge, the innovation either will not occur or will occur at a much later date.

Limiting analysis of the merger to structural effects in the downstream cable market would ignore two important adverse effects. In the cable market, there is an anticompetitive effect stemming from the loss of innovation in the market for aluminum ingot, which compounds the effects of a structural change from duopoly to monopoly in the cable market. Figure 2 shows duopoly prices and costs in the cable market. The process innovation would lower production costs from c_1 to c_1'. As a consequence, duopoly prices would fall from P_{1d} to P_{1d}'. Thus the merger has two effects in the cable market. One is the increase in price of ($P_{1m}-P_{1d}$) that results from diminished competition in the downstream

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[42] If aluminum ingot is purchased rather than produced for captive use, the merger could affect the ability of the merged firms to price discriminate and could affect the incentives to substitute for aluminum ingot if there are variable proportions in the production of the downstream products. These effects depend on the contractual flexibility that exists in the premerger markets. Although these factors could have different consequences for upstream and downstream evaluations of a merger, in most circumstances they are not likely to lead to substantially different conclusions about the competitive effects.

[43] Changes in the cost structure of the merged firm could result from mergers between firms that possess complementary production assets or that exploit economies of scale, as well as from mergers that affect the pace of innovation.
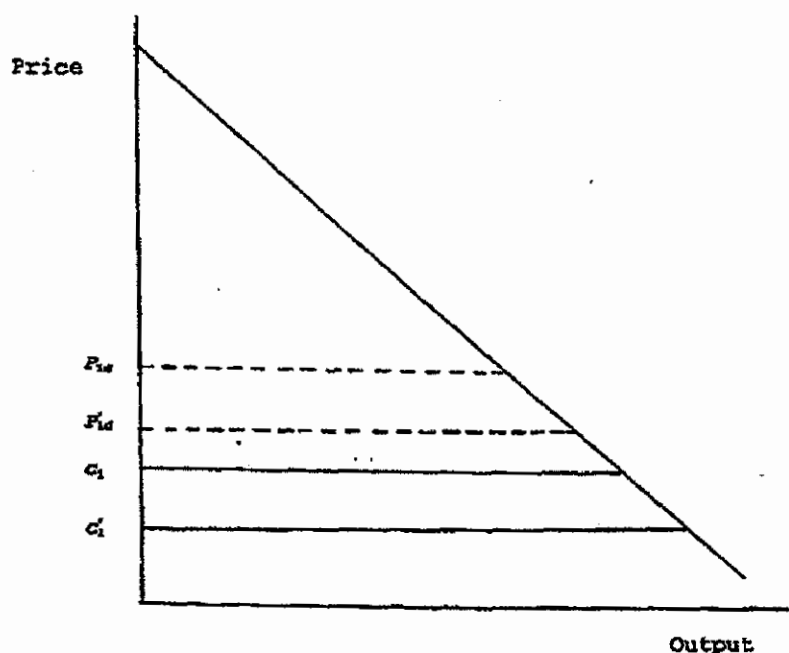
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Figure 2.   Effect of a reduction in unit cost (from c_1 to c_1') on the pre-merger price of aluminum cable.

cable market. The second is an increase in price of $(P_{1d}-P_{1d}')$ from the loss of innovation competition in the ingot market.

The competitive effects of the process innovation do not end with the cable market. Lower production costs will benefit consumers of lawn furniture, even if the monopolistic structure of the lawn furniture market is unchanged by the merger. Figure 3 shows the monopoly price of lawn furniture post-merger. The unit production cost is c_2 and the monopoly price is P_{2m}. Absent the merger, the lawn furniture market would still be a monopoly but in our hypothetical case, the process innovation would have reduced the unit production cost of lawn furniture to c_2'. The corresponding monopoly price would be reduced to P_{2m}'. This follows from the standard monopoly pricing formula,

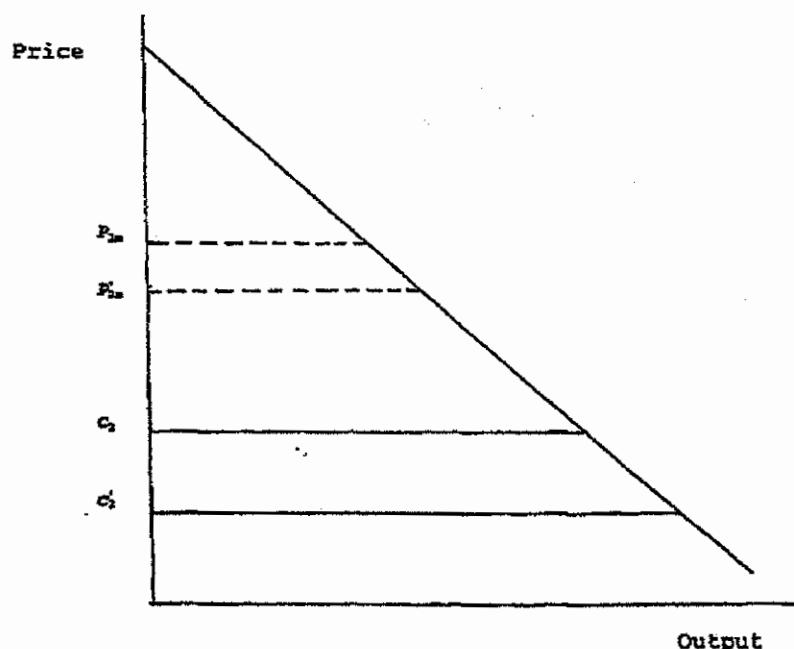$$\frac{P_m - C}{P_m} = \frac{1}{\epsilon}.$$

Figure 3. Effect of a reduction in cost (from c_2 to c_2') on the monopoly price of lawn furniture.

The markup of price over marginal production cost is inversely proportional to the magnitude of the elasticity of demand. Thus a decrease in marginal cost is likely to reduce the price, even for a monopolist.

As compared to an analysis that focuses solely on the change in the structure of downstream markets, analyzing the effects of the merger upstream where the process innovation occurs uncovers three additional competitive effects. These are: the reduction in the cost of aluminum ingot ($c - c'$); (2) the price increase ($P_{1d} - P_{1d}'$) in the cable market; and, (3) the price increase ($P_{2m} - P_{2m}'$) in the market for lawn furniture. The two downstream product price effects stem from the reduction in the cost of aluminum ingot. In addition, by lowering the cost of production, innovation makes it more likely that existing firms will be able to penetrate new markets, such as auto parts. All of these effects result from a reduction of actual current competition in R&D.

The analysis of product, rather than process, innovation is similar. Present competition in R&D is likely to generate new products and hence

is a driving force for future competition in downstream product markets. In addition, as in the case of process innovation, R&D directed to new or improved products is likely to have spillover benefits in markets where the firms do not presently compete. In our aluminum hypothetical, if R&D by ingot manufacturers generated new or improved lawn furniture products, these new products would be available for use to the benefit of consumers in the monopolized markets where these products are sold. These benefits would be realized notwithstanding the absence of any change from a merger in the structure of the monopoly lawn furniture markets.

The FTC's complaint in Roche Holding's acquisition of Genentech illustrates an application of the innovation markets approach. The relevant product markets in the FTC's analysis of the transaction were "the research, development, production and marketing of: (1) vitamin C, (2) therapeutics for treatment of human growth hormone deficiency or other short stature deficiency, including human growth hormone and human growth hormone releasing factor, and (3) CD4-based therapeutics for the treatment of AIDS and HIV infection."[44] For each of these compounds, the FTC alleged that the acquisition would affect competition in R&D leading to the development of new and improved products.

Concerns about effects on innovation were particularly applicable to therapeutics for the treatment of human growth deficiency and for AIDS/HIV infection. Genentech was a dominant supplier of human growth hormone and Roche had conducted advanced clinical trials for a potentially competitive product. Genentech was the most advanced of a limited number of companies developing CD4-based therapeutics for the treatment of AIDS/HIV infection and Roche was engaged in R&D on these products. The acquisition posed a threat to potential competition in the supply of these new products. More directly, the FTC alleged that the acquisition would have lessened actual competition in research and development directed at these classes of therapeutics.[45]

A second example of merger policy that focused on the market for innovation is the Antitrust Division's investigation into the proposed acquisition of General Motor's Allison Division by ZF Friedrichshafen.[46] The two companies proposed combining their large truck and bus automatic transmission businesses. Some bus and truck applications used automatic transmissions, while many others used manual transmissions.

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[44] Roche Holding Ltd., FTC No. C3315 (filed Nov. 28, 1990).

[45] Id. at 3.

[46] See United States v. General Motors Corp., No. 93-530 (D. Del. filed Nov. 16, 1993).

Automatic transmissions used in different bus and truck applications, although often physically similar, typically were sold at different prices.

GM and ZF were the two largest producers of heavy-duty automatic transmissions in the world, accounting for about 85 percent of total production. GM was the dominant seller of these products in the United States while ZF was dominant in Europe. Both companies competed in some but not all application markets for bus and truck automatic transmissions, and the acquisition would have led to very high levels of concentration in certain bus and truck transmission markets in the United States.

The Antitrust Division challenged the proposed GM-ZF acquisition, alleging that it would pose serious harm to competition in certain bus and truck transmission product markets. The complaint also alleged that the acquisition would harm innovation in the design and improvement of automatic transmissions for heavy-duty trucks and buses—in other words, that excessive concentration threatened innovation.

As in our hypothetical example, the elimination of competition in innovation likely would have had an adverse impact on consumers in the markets where GM and ZF competed. In addition, the acquisition would have affected other automatic transmission markets supplied by only one of the firms, because the prices and performance of transmissions in those markets were likely to be affected by innovations in design and product improvements. In the United States, ZF sold transmissions in only a few of the downstream transmission product markets where GM was also a supplier. However, any improvements in GM's products resulting from innovation competition with ZF would have benefited GM's customers, whether or not these transmissions were sold in actual or potential competition with ZF. Innovation competition also would have affected the likelihood that automatic transmissions would penetrate other transmission markets that are dominated by manual transmissions.

A merger that affects innovation, therefore, can have consequences for consumers in markets where the merging firms do not compete prior to the merger. This can come about through cost increases from the merger, suppressed product improvements, or from reductions in future competition. These effects can be analyzed more directly by focusing on innovation markets.

V. INNOVATION MARKETS ANALYSIS IN PRACTICE

The innovation markets approach poses several practical difficulties in addition to the conceptual problems discussed in the preceding sec-

tions. In this part, we identify the circumstances that hinder or facilitate the analysis of innovation markets and suggest when such an analysis would be futile.

Defining innovation markets is more likely to be feasible when innovation requires specific assets and the population of firms possessing those assets can be reasonably identified. Identification of the boundaries of the relevant innovation market is the most significant practical problem.

Innovation may come from many unexpected sources. Consider the various technologies that have achieved wide application in the medical diagnostic device industry.[47] Technologies such as conventional X-ray machines, computer tomographic scanners, nuclear imaging, magnetic resonance, and digital radiography perform similar functions and are partial substitutes. The potential sources of innovation include all of the existing technologies that can be used for similar diagnostic functions at comparable costs as well as yet unknown technologies.

Even within a well-established technology, the potential sources of innovation are many and diverse. The success of computer tomographic scanners was as much the result of advances in computing power and software as of advances in X-ray devices. Advances in semiconductor measurement technologies often were pioneered by firms with unique capabilities in optics technologies rather than by firms in the conventional semiconductor fabrication industry.[48]

The sources of innovation may not be reliably identified unless innovation would be unlikely in the absence of specialized assets. If the firms that possess these specialized assets can be identified, then the population of potential innovators can be determined. Identifying the universe of potential innovators is only a first step in analyzing the effects of increased market concentration on innovation. Such identification, however, is a necessary step.

As an example, the focus of innovation in the GM-ZF case was on improvements to heavy-duty automatic transmissions and on reductions in the cost of producing these products. Given the time required to enter the heavy-duty automatic transmission business, the population of potential innovators could be limited to those firms that had the ability to produce these products. The relevant specialized assets were the assets required to manufacture heavy-duty automatic transmissions, assets possessed by only a few firms worldwide.

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[47] Hartman et al., *supra* note 7.

[48] *See* Henderson, *supra* note 25.

FTC v. PPG Industries[49] also illustrates the role of specialized assets in determining the population of potential innovators. In that case, Judge Bork affirmed a product market definition of "aircraft transparencies requiring, for want of a better term, 'high technology' to produce."[50] Judge Bork's market definition was based partly on the perception of market participants and consumers that only certain firms possessed the technological capability (specialized assets) to develop new materials in response to airplane manufacturers' requests for bid proposals.[51]

The market that Judge Bork defined in *PPG Industries* was not, strictly speaking, an innovation market. Rather, it was a market for the production of present and future goods (aircraft transparencies) using innovative processes.[52] The court's analysis, however, did address expected competitive effects in markets for new products whose underlying technology was changing rapidly. To that extent, the court dealt with many of the issues that would arise in a more direct analysis of innovation markets.

Using specialized assets to define the population of potential innovators facilitates evaluation of a merger's effect on the probability of innovation. Consider the example of improvements to heavy-duty transmissions. Assuming that production is a critical input to innovative ability, it may be possible to define a stock of firm-specific knowledge capital, which is related to current and past production volume. Such a variable seems particularly relevant in the context of process innovation and also for products marked by strong learning-by-doing.

In the proposed GM-ZF acquisition, the Antitrust Division approximated the stock of knowledge capital by the current level of production. A more precise measure might be the discounted sum of total production, with the discount rate being the estimated rate of R&D depreciation.[53] If Q_t is production in year t, and δ is the rate of R&D depreciation, the estimated stock of knowledge Z_t would be defined by the formula[54]

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[49] 628 F. Supp. 881 (D.D.C.), *aff'd*, 798 F.2d 1500 (D.C. Cir. 1986).

[50] 798 F.2d at 1502.

[51] *Id.* at 1504 ("PPG and Swedlow perceive themselves to be competitors in the evolving high technology market, as do the aircraft manufacturers who request proposals for, and eventually purchase, the transparencies.").

[52] The court's conclusion that the firms were in competition was premised on, among other things, actual competition for the transparency to be incorporated in the V-22 tilt rotor aircraft.

[53] Bronwyn H. Hall, *The Impact of Corporate Restructuring on Industrial Research and Development*, BROOKINGS PAPERS ON ECONOMIC ACTIVITY: MICROECONOMICS 85 (Martin N. Bailey & Clifford Winston eds., 1990) (macro-level estimates of the rate of depreciation of R&D).

[54] The knowledge capital stock of the combined firms may be larger than the sum of their premerger knowledge capital stocks owing to integrative efficiencies in R&D, or less

$$Z_t = \sum_{\tau=0}^{t} \frac{Q_{t-\tau}}{(1+\delta)^\tau} .$$

Analysis of the effects of a change in market structure on R&D involves answering the following three questions. First, does the merged firm have the *ability* to decrease total market investment in R&D? Second, does the new combination have the *incentive* to reduce innovative effort? Third, does the merger have any consequences for the *efficiency* of R&D expenditure? The delineation of an innovation market facilitates analysis of the ability of the merged firm to decrease total investment in R&D. Even if the merged firm has such an ability, it may have no incentive to reduce R&D. The desire to penetrate other downstream markets, as well as competition from existing innovators, may provide a sufficient stimulus for innovation even when a merger results in extremely high levels of market concentration. Finally, a case alleging that an acquisition would impede innovation and harm consumer welfare must show that the merger does not entail offsetting efficiency benefits.

A. THE ABILITY OF THE MERGED FIRM TO REDUCE TOTAL R&D

Assessment of the ability to reduce innovative effort requires an evaluation of R&D sources that are not controlled by the merged firm. This is analogous to the determination of a merged firm's share of the relevant market in a horizontal product merger. In the GM-ZF case, the ability requirement was satisfied by a showing that GM and ZF together represented a significant fraction of the resources that were expended on innovation for heavy-duty automatic transmissions and of those that were likely to be expended in the near future.

The merged firm's share of the assets required to engage in R&D is an indicator of the merged firm's unilateral ability to reduce total R&D directed at particular new products or processes. The merged firm would not be able to profit from a reduction in total R&D spending if there are many other innovators, so that the risk of losing the innovation race would be too great, or if other firms could easily expand their R&D efforts and would do so in response to a reduction in R&D effort by the merged firm. The expansion of R&D effort could come from existing firms in the industry, from firms outside the industry that possess the assets required to develop particular new products or processes, or from firms that newly acquire the requisite R&D capabilities.

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due to redundant R&D efforts. This is not fundamentally different from merger effects on productive capital, which may effectively exceed the sum of premerger capital stocks due to complementarities, or be less due to redundancies.

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If the merged firm's control of R&D assets is not sufficient to give it the unilateral ability to reduce total industry R&D effort, then a relevant consideration is the feasibility of collusion with other firms in an attempt to reduce R&D. Sustainable collusion requires either an explicit or an implicit agreement as to the division of benefits from the collusion as well as the means to monitor and enforce the agreement. In addition, the cartel must be protected from the possibility of entry. A group of firms may profit from collusion in R&D by reducing expenditures toward levels that would be desired by a firm with a monopoly in R&D.

The conditions required to sustain a collusive agreement, however, are particularly difficult to satisfy when the coordinated activity is research and development. Firms are likely to benefit in different ways from a successful R&D program and agreement over the "spoils" of coordinated R&D activity is likely to be difficult. Monitoring will also be difficult since R&D typically involves private information. A firm that succeeds in an R&D program gains a substantial advantage over its competitors and retaliation by its unsuccessful rivals may be difficult or even impossible. In addition, when R&D does not require specialized assets, any collusive agreement to suppress R&D will be vulnerable to entry from innovators that are not members of the agreement.

The likelihood of collusion also should be low when the affected output markets are competitive, even if ownership of the specialized assets necessary to engage in R&D is concentrated. The reason is that colluding firms would have no incentive to reduce R&D in order to protect the flow of profits from existing products.[55] Even in this circumstance, however, the joint interests of the firms may be to avoid an R&D race and save costs by slowing down the pace of innovation.[56]

The risk of collusion to restrain R&D should be very low when innovation is drastic. A drastic innovation is one that is so superior to existing products in cost or functionality that existing products are not competitive, even when priced at marginal cost. A firm that produces such a drastic innovation wins the whole market for a period of time that depends on barriers to imitation, and so has a strong temptation to deviate from an agreement to suppress innovation. Moreover, its rivals have little power to punish such a firm for deviating. They cannot punish a

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[55] *See* Kattan, *supra* note 24; Ordover & Willig, *supra* note 24.

[56] *See* Joseph F. Brodley, *Antitrust Law and Innovation Cooperation*, 4 J. ECON. PERSP., Summer 1990, at 97; Katz, *supra* note 24; Shapiro & Willig, supra note 24.

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successful innovator by reducing prices because the innovator has made
a quantum jump to a new market in which they do not compete.[57]

Generally speaking, collusion in R&D should be more difficult the
greater the competitive significance of innovation and the greater the
level of competition affected by the innovation. Collusion is more likely
when R&D is directed at incremental improvement in products or costs.
As an example, the Antitrust Division charged that the three major U.S.
automobile manufacturers coordinated behavior to eliminate competi-
tion in the research, development, manufacture, and installation of mo-
tor vehicle pollution control equipment.[58] A firm that deviated from an
agreement to suppress R&D in pollution control equipment could gain
a competitive advantage. However, the remaining firms could negate
this advantage by convincing regulators to delay the implementation of
stricter air pollution control requirements (by making the case that the
technology is not ready) and by punishing the defecting firm with more
aggressive pricing.

B. THE INCENTIVE OF THE MERGED FIRM TO REDUCE TOTAL R&D

The ability to reduce significantly the total amount of R&D does not
mean that a merged firm has the incentive to reduce innovation. Compe-
tition from other downstream products and competition from other
firms that have the necessary specialized assets may lead the merged
firm to maintain (if not increase) the premerger level of innovative effort.
Consider again the example of the merger of aluminum ingot producers
whose R&D expenditures are directed to improvements in their cable
and lawn furniture products. Suppose they compete against copper pro-
ducers in the market for cable and against producers using plastic, wood,
and metals other than aluminum for outdoor furniture. If the down-
stream product markets are competitive, the merged firm would have
an incentive to invest in R&D in order to increase the market shares and
profitability of its downstream products.[59]

Even if downstream markets are not competitive, the potential for
downstream competition can be an incentive for the merged firm to
maintain its premerger level of innovative effort. For example, suppose
that copper cable is a monopoly, but at present costs the aluminum

[57] "Winner-take-all" innovation need not qualify as drastic if the industry has a pattern
of leapfrog competition, in which firms in the industry alternately introduce new products
that achieve only a brief monopoly.

[58] United States v. Automobile Mfrs. Ass'n, 307 F. Supp. 617 (C.D. Cal. 1969).

[59] This is a special case of the general effect of downstream competition on the market
for an input. For example, the price that a railroad boxcar monopolist can charge is limited
by competition to railroad freight traffic from trucks and barges.

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producers cannot compete with copper for most uses even at its monopoly price. The merged aluminum producers may have an incentive to invest in R&D to lower their production costs so that they may penetrate markets that are currently dominated by copper.

Actual and potential downstream competition is an important factor in the incentive of the merged firm to invest in R&D. Competition in the markets for final products, both actual and potential, affects the magnitude of the payoff to the merged firm from its R&D efforts. The merged firm has an incentive to invest more in R&D as its payoff increases, and its payoff can be expected to be larger when the merged firm can take market share away from competing suppliers of downstream products.

Competition in downstream markets is not, however, a perfect substitute for competition in R&D and does not assure that the merged firm will continue to invest in R&D at premerger levels. A merger of firms' R&D capabilities is likely to affect the dynamics of R&D competition when the merged firms control a significant share of the assets required for innovation of particular new products or processes. Firms that compete in R&D are likely to dissipate profits in a race to be the successful innovator. A merged firm that has a monopoly or near-monopoly in R&D would invest at a level that maximizes its profits. This is likely to be less than the total level of R&D when the firms compete, although the difference may not be substantial if the payoff to R&D is large.[66]

An analysis of the incentives to invest in R&D following a merger or other combination thus entails two levels of investigation. The first evaluates the activities that may substitute for a reduction in R&D effort by the combined firms. The second considers the effects of competition in downstream product markets on the incentives to invest in R&D. The two-level analysis is appropriate because R&D is an intermediate input into production. The competitive effects of a merger or other combination in an intermediate product market depend not only on the substitutes that are available for the intermediate good, but also on competition in the downstream markets that use the intermediate good.

C. CONSEQUENCES OF THE MERGER FOR THE EFFICIENCY OF R&D EFFORT

Analysis of the effects of a merger on innovation also requires an evaluation of efficiency considerations that might lead a merged firm to

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[66] The dissipation of profits would be socially wasteful if firms are able to appropriate completely the benefits of their R&D efforts. *See* Yoram Barzel, *Optimal Timing of Innovations*, 50 REV. ECON. & STAT. 348 (1968). However, evidence suggests that the private return to

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engage in greater innovative activity or in the same amount at a lower cost. As discussed in Part III, the merging firms might possess complementary assets that increase the efficiency of research and development,[61] the combined firm might be able to exploit economies of scale in R&D, and the combined firm may be able to eliminate redundant R&D activities and thus lower costs without significantly reducing innovation.

These R&D efficiency consequences do not differ qualitatively from the production efficiencies that may be realized in a merger. Antitrust authorities are familiar with incorporating such efficiencies into merger analysis. R&D does not add new challenges in this respect, although some maintain that there should be a greater presumption that a merger has positive implications for the efficiency of research and development activities.[62]

VI. A ROUGH GUIDE TO THE INNOVATION MARKETS APPROACH

Having explored the theoretical value and the practical utility of innovation markets as a tool in antitrust analysis, we outline below the important elements of the approach. The innovation market methodology is described in the context of evaluating the effects of a hypothetical merger on R&D, but it would apply to evaluating other arrangements, such as R&D joint ventures. As in the analysis of the effects of a merger on price competition, the first step is to identify the relevant R&D product and geographical markets where competition in research and development may be affected by a proposed merger or acquisition.

The approach to defining an innovation market is intended to parallel the mode of analysis described in the 1992 Horizontal Merger Guidelines, adapted to fit the particular circumstances of research and development. In general terms, an innovation market is defined as a set of activities and a geographical area in which a hypothetical monopolist would impose at least a small but significant and nontransitory reduction in R&D effort. This is similar to the "small but significant and nontransitory increase in price" that is central to the methodology of product market definition in the 1992 Merger Guidelines. For innovation markets, the logical presumption is that the relevant geographical market is

R&D is much less than the social return (see Mansfield et al., supra note 17), so the economic allocation of resources is likely to be improved when firms compete aggressively in R&D, even if such competition dissipates profits.

[61] See, e.g., David J. Teece, Towards an Economic Theory of the Multiproduct Firm, 3 J. ECON. BEHAV. & ORG. 39 (1982); Teece, supra note 25.

[62] See, e.g., Ordover & Willig, supra note 24; Ordover & Baumol, supra note 24; Yao & DeSanti, supra note 11.

the world (assuming that no trade or regulatory barriers would prevent R&D at particular locations).

Consistent with the 1992 Horizontal Merger Guidelines, the innovation markets approach also includes assessments of market concentration, competitive effects on incentives to invest in R&D, and efficiencies resulting from a combination of R&D activities. The steps in this analysis are outlined below.

1. *Identify the Overlapping R&D Activities of the Merging Firms.* The definition of a relevant R&D product market begins with the identification of the set of overlapping R&D activities of the merging firms. Such activities are economically relevant only if they may lead to improved products or processes. Thus, it is necessary to establish that the outcome of a proposed set of R&D activities can have a significant impact in one or more relevant downstream product markets as a precondition for including the R&D activities in a relevant innovation market.

2. *Identify Alternative Sources of R&D.* The purpose of this step is to identify the R&D activities that are reasonable substitutes for the activities of the merging firms. This corresponds to the evaluation of demand substitution in the Merger Guidelines. In the case of innovation, the "product" is R&D directed to particular new products and processes, which entails a set of activities including the required scientific skills and equipment. Because the product is a set of activities, rather than a particular good or service, it is both analytically and practically easier to identify the firms that possess the capabilities to supply these activities, rather than attempt to categorize each activity separately.

A reduction in R&D by a monopolist in the assumed set of activities may be unprofitable because there are many alternative sources of R&D, so that a firm would not want to risk losing the R&D race, or because other firms would respond by increasing their R&D activities, with the result that the monopolist would be less likely to succeed in introducing new or cheaper products. Evaluating these alternatives parallels the evaluation of alternatives available to consumers in the delineation of downstream product markets. As in that analysis, it would be reasonable to include not only those firms that currently possess the necessary specialized assets for R&D, but also those firms that could be expected to acquire those assets within a reasonably short time period in response to a small but significant and nontransitory reduction in R&D.[63] This corresponds

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[63] Evaluating competitive effects necessarily requires a forecast into the future which becomes more uncertain with a longer time horizon. These uncertainties are likely to be overwhelming for forecasts of competitive effects from innovation that extend beyond several years. In estimating whether a firm would be able to acquire the assets necessary

to competition from downstream products analyzed in Step 3) that affect the likelihood that the merger may have an impact on competition. The proper measure of the merged firm's share of innovation activity will depend upon individual circumstances.[64] Expenditures on research and development can be used if the expenditures can be localized to R&D leading to the relevant new products or processes. In other situations, the level of activity (such as production) or the level of assets may be better correlated with the probability that a firm will be a successful innovator. (For example, production levels, or appropriately weighted past production levels, may be a reasonable measure of a firm's position on a learning curve and thus its ability to introduce new process innovations.) If firms in the identified population of innovators are equally likely to be successful, the proper measure would assign each firm an equal market share.

As discussed in Part V above, adverse impacts on R&D are more likely to occur from the unilateral exercise of market power by a merged firm that controls a large share of an innovation market. Collusion in R&D is difficult, especially if an innovation would be likely to have a significant impact on existing competitive relationships.[65]

5. *Assess R&D Efficiencies.* The final step in the analysis of a merger or other combination that might affect investment in R&D is to evaluate the consequences for the efficiency of R&D. It is clearly not sufficient to end the evaluation with a determination only of the likelihood that the combination will reduce R&D effort. The relevant competitive concern is whether the combination will have an adverse impact on innovation, for which R&D is only an input. The analysis must consider whether the merger or other combination affords efficiency benefits that enhance the likelihood or value of innovation. This requires evaluating the potential for exploiting complementary R&D assets and scale economies in R&D as well as for eliminating redundant R&D programs.

VII. INNOVATION MARKETS AND THE CLAYTON ACT

The innovation markets framework provides a methodology for identifying mergers that are likely to affect competition in output markets

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[64] In some cases, evaluation of the merging firms' ability to reduce R&D spending and innovation may be aided by direct evidence from the firms' strategic planning documents.

[65] Consistent with these observations, William Baxter concluded in the context of evaluating R&D joint ventures that "[I]f the R&D group is not, in the aggregate, more than 33 percent of the R&D-oriented assets in the field that is under consideration—in short, if there are enough people left out to put together another two such groups like the one we have—we probably should let it go forward, at least on the basis of any substantial showing that that much aggregation is necessary in order to achieve economies of scale." Baxter, *supra* note 6, at 722–23.

to the evaluation of supply substitution and entry in the Merger Guidelines.

In many market circumstances there is so much serendipity in research and development that it is impossible to predict the sources of innovation with reasonable certainty. It is unlikely that combining the R&D activities of the merging firms would have a significant impact on innovation in these circumstances. The delineation of innovation markets should be limited to markets in which R&D directed toward particular new products or processes requires specific assets that are possessed by identified firms. If innovation directed to particular products or processes does not require specific assets, entry into R&D would be easy and the innovation market would be competitive. If such innovation does require specific assets, it may nonetheless be inappropriate to delineate an innovation market if the firms that possess those assets cannot be reliably identified to provide sufficient certainty as to the proper boundaries of the innovation market.

3. *Evaluate Actual and Potential Competition from Downstream Products.* In addition to competition from alternative technologies, a second reason why a reduction in R&D may be unprofitable for a hypothetical monopolist is actual and potential competition from downstream products. Innovation permits the hypothetical monopolist to increase its share of downstream markets and be more profitable. A downsized R&D program would make it more difficult for the R&D monopolist to enter new markets where it does not presently compete. If the resulting loss of competitive opportunities would exceed any savings in R&D expenditures so that a reduction in R&D would not be profitable, a merger or acquisition would not have an adverse impact on the level of R&D effort. In this circumstance, a merger or other combination would not adversely affect incentives to invest in R&D. This may be true even if the firm were a monopolist in all of the substitutes for the R&D activities of the merging firms.

4. *Assess the Increase in Concentration in Research and Development and Competitive Effects on Investment in R&D.* A relevant innovation market is established when the analysis identifies the set of R&D activities for which a hypothetical monopolist would profit by a small but significant and nontransitory reduction in R&D. Having defined the innovation market, an analysis of a merger involving R&D must consider whether the merged firm's share of R&D is sufficient to affect the total level of R&D in that market, and whether there are any particular factors (in addition

to engage in R&D, a two-year horizon would be consistent with the analysis of entry in the Merger Guidelines. *See* 1992 Merger Guidelines, *supra* note 10, § 3.2.

through a lessening of innovation. Assuming that such an effect can be shown, can a plaintiff allege a violation of Section 7 of the Clayton Act? Does the legal viability of an innovation market turn on whether the fruits of innovation are sold in classical "buyer-seller" transactions or whether all innovation is pursued by firms that are totally integrated vertically?

Section 7 of the Clayton Act provides that no person shall acquire the stock or assets of another person "where in any line of commerce or in any activity affecting commerce in any section of the country, the effect of such acquisition may be substantially to lessen competition, or tend to create a monopoly."[66] The Supreme Court has held that "line of commerce" refers to the relevant product market, which in turn the Court has declared an important dimension of "the area of effective competition."[67] Product market boundaries are typically drawn with reference to price elasticities of goods and services sold in commerce.[68]

Generally speaking, an allegation of reduced competition in innovation can be incorporated into Section 7 analysis in at least three ways. First, a reduction in innovation can be characterized as a competitive effect in a goods or services market.[69] Second, dampened innovative activity could be an integral part of a claim of reduced potential competition.[70] Third, an innovation market can be used to identify the areas in which the proposed merger is likely to lessen competition in output markets.[71]

For the reasons discussed in Part IV, neither the competitive effects analysis nor the potential competition theory is fully satisfactory in capturing the effects of some mergers. Although loss of innovation is certainly an anticompetitive effect under existing case law, reliance on this mode of analysis may not allow identification of all markets that are harmed by the loss of innovation resulting from the merger. Moreover, even if all the affected markets could be identified, there may be no antitrust violation under traditional methods of analyzing horizontal or vertical mergers if the merging firms are neither competitors nor vertically related.

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[66] 15 U.S.C. § 18.

[67] Brown Shoe Co. v. United States, 370 U.S. 294, 324 (1962).

[68] See, e.g., 1992 Merger Guidelines, supra note 10, §§ 1.0, 1.31.

[69] PPG Indus., 628 F. Supp. at 885 (the court delineated a market for aircraft transparencies, an output market, and found that the merger could lead to "a decline in vigorous inter-material [glass and acrylic] research and development. . . .").

[70] Institut Merieux S.A., 5 Trade Reg. Rep. (CCH) ¶ 22,779 at 22,505 (1990) (alleged that the proposed merger would eliminate competition expected with the introduction of a new product).

[71] United States v. General Motors Corp., No. 93-530 (D. Del. filed Nov. 16, 1993).

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The theory of potential competition also fails to capture all markets that could be harmed by the loss of innovation competition.[72] As the example of the aluminum manufacturer described in Part IV shows, a merger that lessens innovation could result in increased prices in one or more markets in which only one of the merging firms participates and the other firm is *not* an actual or perceived potential competitor. Focusing on innovation cures these deficiencies in the analysis. The innovation markets framework provides a principled basis for identifying all relevant welfare losses in output markets due to reduced innovation competition. It reaches mergers with demonstrable anticompetitive effects not captured by other methods of analyzing mergers.

When the outputs of innovation are sold directly in commerce, allegation of an innovation product market should not be difficult. Disembodied technology is the "product" and familiar principles of market definition can be applied to "market" transactions. Examination of demand-side and supply-side criteria can be tapped to identify market boundaries and participants, concentration can be measured, and competitive effects can be analyzed.

Innovation may be sold in commerce in many ways. For example, firms may sell research in the form of intellectual property licenses.[73] Certain firms may offer research and development services to production firms. Certain customers, notably the Department of Defense, may seek bids only for the "development" stage of a proposed procurement. Finally, two or more firms may cooperate in an R&D joint venture. Although such a venture may not make market sales in the strictest sense, it seems unlikely that it would escape Section 7 scrutiny since the venture will eventually transfer technology back to its members.[74]

Supporting an innovation market may be more difficult when all innovators are downstream producers and there are no market sales of tech-

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[72] The potential competition theory requires, *inter alia*, that one of the two merging firms participate in a concentrated market and the other be an actual or perceived potential entrant. *See, e.g.*, United States v. Marine Bancorporation, 418 U.S. 602, 639–40 (1974) (perceived potential competition); Mercantile Tex. Corp. v. Board of Governors, 638 F.2d 1255, 1265 (5th Cir. 1981) (actual potential competition).

[73] *See* U.S. Department of Justice, Antitrust Guidelines for the Licensing and Acquisition of Intellectual Property § 2.3, 59 Fed. Reg. 41,339 (Aug. 11, 1994) (draft), *reprinted in* 7 Trade Reg. Rep. (CCH) ¶ 50,141; *see also* United States v. Radio Corp. of Am., 1954 Trade Cas. (CCH) ¶ 67,704 (D. Del. 1954) (patent pooling).

[74] There is statutory authority for the use of R&D markets in the evaluation of research joint ventures. The National Cooperative Research and Production Act of 1993 requires that conduct in a joint R&D venture be evaluated "taking into account all relevant factors affecting competition, including, but not limited to, effects on competition in properly defined, relevant *research, development*, product, process, and service markets." 15 U.S.C.A. § 4302 (1994) (emphasis added).

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nology. There is some suggestion that courts will reject the concept of an innovation market when the relevant technology is fully embodied in the product and is not available separately. For example, in *American Medicorp, Inc. v. Humana, Inc.*,[75] the district court rejected the plaintiff's claim of a market for the development of new hospitals. It reasoned that such development was "a normal internal activity in which no *market* transaction occurs at all. ... *There is neither buyer nor seller, nor even the slightest trace of competition in such a transaction.*"[76] Other courts have also expressed skepticism about markets without commercial transactions.[77]

A finding of illegality under Section 7 must rest on a probable effect on commerce. Unless technology is sold in a classical "buyer-seller" transaction, such an effect can come about only if the innovation is incorporated into a product that ultimately is sold downstream to consumers. Judicial rejection of the innovation markets approach on the ground that innovation was not sold separately from the final product, however, would allow mergers with a demonstrable anticompetitive effect to go unchallenged. Such rejection would be unwarranted to the extent that the innovation markets approach identifies welfare losses in output markets. Although the innovation markets framework begins by identifying the effects on innovation, given structural changes in the output market, the question of whether the merged firm has the ability and the incentive to reduce innovation depends to a large extent on the particular configurations of the relevant output markets. The analysis ends with an evaluation of the effects of reduced innovative activity in these markets.

The innovation markets approach is securely grounded in an effect on commerce. It is, therefore, appropriate to incorporate it into Section 7 jurisprudence. One way to do so would be to recognize an "upstream" innovation market or a defined set of technologies as a line of commerce. Under this method of analysis, innovation for a defined group of products would be considered an area of effective competition. If a transaction were to lessen substantially competition in such a market, it would be held unlawful. The product and geographic dimensions of the relevant market for innovation for a defined group of products will not necessarily correspond to the dimensions of the relevant market for those same products downstream. For example, a given technology may be used to produce two different products which, for the purposes of manufacture and sale of those products downstream, compete in separate markets

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[75] 445 F. Supp. 589 (E.D. Pa. 1977).

[76] *Id.* at 598 (emphasis in original).

[77] *See, e.g.*, TV Signal Co. v. AT&T, 465 F. Supp. 1084 (D.S.D. 1979), *vacated on other grounds*, 617 F.2d 1302 (8th Cir. 1980); Babcock & Wilcox Co. v. United Technologies Corp., 435 F. Supp. 1249 (N.D. Ohio 1977).

(e.g., aluminum ingot technology used to produce aluminum cable and lawn furniture). In this instance, there may be a unitary innovation market for the technology to produce the products, but multiple downstream markets for the products themselves. Similarly, the geographic market for a type of innovation may be worldwide while the downstream products that are the focus of that innovation trade in narrower markets (for example, because of the need for specialized distribution assets, freight costs, or regulatory and trade barriers).[78]

An alternative way to fit the innovation markets framework within existing Section 7 case law is to treat the framework as a tool for identifying mergers with anticompetitive effects in output markets. The relevant output markets would be defined by commonly accepted principles of market definition. A merger would be held illegal if the innovation analysis revealed a substantial anticompetitive effect in an output market resulting from reduced innovation competition upstream. As in the aluminum example in Part IV, since the competitive effect arises from upstream competition, a merger could be found to lessen competition substantially without actual or potential competition in particular product markets. A vertical relationship between the merging firms would also be unnecessary. The only requirement would be that the merging firms be significant competitors in innovation and that the reduction in innovation will have a harmful effect in an output market. Section 7 jurisprudence can accommodate the innovation markets approach.

VIII. CONCLUSION

One of the more fundamental criticisms leveled at antitrust enforcement is its traditionally static orientation. Focusing most of its energy towards ensuring productive and allocative efficiency, it has often neglected dynamic efficiency. In a world of rapid technological advance, it is important that antitrust law pay greater attention to innovation issues. Adoption of the innovation markets approach in merger enforcement will help sharpen the focus on technological advancement so critical to the continued growth of our economy. By assigning innovation an important role in merger analysis, the innovation markets approach will aid antitrust authorities to adopt a more dynamic perspective.

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[78] In United States v. General Motors Corp., No. 93-530 (D. Del. filed Nov. 16, 1993), the innovation market was broadly defined as technology for a range of heavy-duty automatic transmissions throughout the world. In contrast, the output markets were limited to specific applications for heavy-duty transmissions in the United States. For discussion of the case, see *supra* text accompanying note 4.